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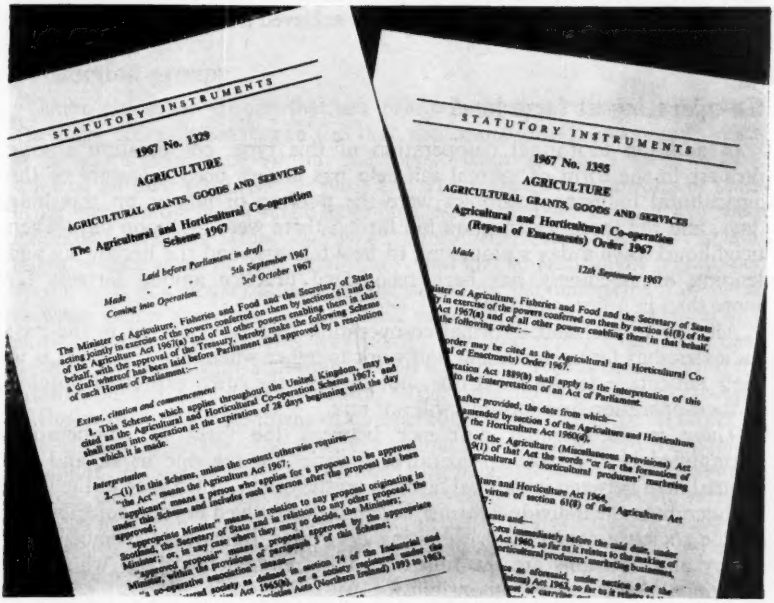

STATUTORY INSTRUMENTS

1967 No. 1329

AGRICULTURE

AGRICULTURAL GRANTS, GOODS AND SERVICES

The Agricultural and Horticultural Co-operation Scheme 1967

Laid before Parliament in draft 5th September 1967

Made 3rd October 1967

Coming into Operation

The Minister of Agriculture, Fisheries and Food and the Secretary of State acting jointly in exercise of the powers conferred on them by sections 61 and 63 of the Agriculture Act 1967(a) and of all other powers enabling them in that behalf, with the approval of the Treasury, hereby make the following Scheme a draft whereof has been laid before Parliament and approved by a resolution of each House of Parliament:—

Extent, citation and commencement

1. This Scheme, which applies throughout the United Kingdom, may be cited as the Agricultural and Horticultural Co-operation Scheme 1967; and shall come into operation at the expiration of 28 days beginning with the day on which it is made.

Interpretation

2.—(1) In this Scheme, unless the context otherwise requires—

"the Act" means the Agriculture Act 1967;

"applicant" means a person who applies for a proposal to be approved under this Scheme and includes such a person after the proposal has been approved;

"appropriate Minister" means, in relation to any proposal originating in Scotland, the Secretary of State and in relation to any other proposal, the Minister; or, in any case where they may so decide, the Ministers;

"approved proposal" means a proposal approved by the appropriate Minister within the provisions of paragraph 7 of this Scheme;

"agricultural association" means—

STATUTORY INSTRUMENTS

1967 No. 1355

AGRICULTURE

AGRICULTURAL GRANTS, GOODS AND SERVICES

Agricultural and Horticultural Co-operation (Repeal of Enactments) Order 1967

Made 12th September 1967

ister of Agriculture, Fisheries and Food and the Secretary of State y in exercise of the powers conferred on them by section 61(8) of the Act 1967(a) and of all other powers enabling them in that behalf, the following order:—

rder may be cited as the Agricultural and Horticultural Co- al of Enactments) Order 1967.

tation Act 1889(b) shall apply to the interpretation of this to the interpretation of an Act of Parliament.

after provided, the date from which—

amended by section 5 of the Agriculture and Horticulture (the Horticulture Act 1960(d).

of the Agriculture (Miscellaneous Provisions) Act 9(1) of that Act the words "or for the formation of gricultural or horticultural producers' marketing

ture and Horticulture Act 1964,

irtue of section 61(8) of the Agriculture Act

nts and—

ases immediately before the said date, under Act 1960, so far as it relates to the making of horticultural producers' marketing businesses,

as aforesaid, under section 9 of the ing) Act 1963, so far as it relates to

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CO-OPERATION means many things to many people. The meaning intended here is simply that individuals operating their own businesses, agree to act together in certain respects instead of acting separately. They do this because they can see advantages to themselves in working in this way. These advantages are sometimes in the production end of the business, marketing or both production and marketing. At all events when co-operation of this type has been successful it has resulted in lower costs or higher production, or both, and the net result has been more successful individual businesses.

A century of co-operation

Co-operation in this sense is not new. For the last 100 years there has been formal co-operation in the form of the large co-operative requisite societies. These societies were formed with the objective of reducing farmers' production costs by securing economies mainly in the purchase of seeds, fertilizers and feedingstuffs. Since the first societies were formed many of the smaller ones have been amalgamated into large organizations which have extended the range of requisites and services with which they have been concerned. An important development of recent years has been the provision by some societies of marketing services for their members. This has been particularly successful in the case of the marketing of horticultural produce, where co-operatively organized societies have established central packing centres and distribution depots where produce can be graded, attractively packed and efficiently distributed.

These societies were formed and are sustained by farmers' capital. They have progressed because they are performing services in the buying and selling fields more effectively than could be achieved if farmers were operating as individuals.

Co-operating at farm level

In addition to formal co-operation of this type, co-operation among farmers in the form of mutual self-help has always been a feature of the agricultural industry. Examples were the pooling of labour on threshing days, and for sheep shearing on hill farms; there were the boon days when neighbours gave a day's ploughing to new tenants; and the borrowing and lending of machinery has been recognized practice among farmers far more than in other industries.

All this formal and informal co-operation that has occured in the past indicates that farmers can and will work together when they can see it is to their advantage to do so. It does not support the often expressed opinion that co-operation and farming will not mix.

There is an essential difference between the form of co-operation exemplified in the large co-operative societies on the one hand, and the mutual help between individual farmers on the other. In the case of the large co-operatives the individual farmer is very little involved beyond contributing to the society's capital and exercising his voting rights as a member. The policy and decisions are the function of the elected board, to whom the individual delegates his responsibility.

The individual is very much involved on a personal basis when it is a case of co-operation at farm level. Here, relevant matters are the best use that can be made of the personal resources of each individual farmer including his knowledge and experience as well as labour, machinery, livestock, buildings and land. The farmers themselves must make decisions on whether and how they can usefully co-operate.

Marketing groups

Since the last war the old informal customs of mutual self-help have been on the decrease. During the last decade, however, there has been renewed interest in co-operation at the farm level, and this has given rise to the

group movement. Numerous buying groups have been set up throughout the country whose aim is to secure economies in the purchase of requisites by the placing of bulk orders. Other groups have been formed to market members' produce. They aim to sell produce on a group basis on better terms than each farmer could secure as an individual. There have been marketing groups for eggs, broilers, weaner pigs, calves, fatstock, cereals, potatoes and horticultural produce. These groups have found that marketing advantage largely depends on offering for sale more precisely what the customer wants. Potato groups need to know what varieties and sizes of potatoes are required; calf groups, the age, size and breed of cattle; horticultural groups need to know the type of vegetables, including the quality and when they are required. Having discovered their customer's requirements it is necessary to ensure that the members of the group produce the required article. Thus marketing groups often tend to become increasingly concerned with matters of production. Group members have often found it necessary to agree to adjust their methods of production to the required standards. Thus what started as a marketing group, often becomes a production group.

Production groups

There are other groups that are primarily concerned with production. These are generally smaller in size than marketing groups and might consist of no more than three or four members. Group members agree to pool some or all their resources for joint use. There are a few examples of plans being made to operate a single large business rather than a number of small individual concerns. Thus, one large, dairy herd, sheep flock or pig unit might replace three or four small units, and all the land might be cropped on the basis of a single rotation. At the same time the management is shared between group members so that each member is able to specialize in a particular enterprise. In this way labour and machinery costs have been reduced and overall production has been increased. This is co-operation for production in a very advanced form. Often production groups of this type started with very simple forms of co-operation. The starting point might be a machinery syndicate. The joint use of machinery can lead to the pooling of labour, leading on to jointly planned cropping and stocking programmes. In some cases the starting point has been agreement to sow specific varieties of crops in response to identified market needs. This has led to the adoption of uniform production methods and planning of the use of other resources on a group basis.

Another form of co-operation with special production objectives is represented by livestock improvement groups. These groups aim to provide to their members services that would otherwise not be available. Livestock improvement groups aim to help members improve the value of their livestock by providing advice and facilities for livestock improvement which can only be effective on a group basis. An important aspect of their work is co-operative-breeding projects based on performance records kept by members.

Larger scale production

Why has there been this resurgence of interest in co-operation at the farm level in recent years? The basic reason is that farmers are becoming

increasingly aware of the disadvantage of operating on a small scale, both in production and marketing. On the production side, the main factor in this connection is the heavy capital requirement of modern farming. With the value of land at three or four times what it was at the end of the war, the need for intensive production has become imperative. More stock must be carried and more crops grown per acre, and this must be achieved with a reduced but more costly labour force. This requires further capital investment in livestock, seed, fertilizer, sprays, and specialized machinery and buildings. Thus, to the high cost of land must be added the heavy investment required to stock and equip it for intensive production. Heavy capital investment of this order requires that the scale of production be large enough to enable fixed equipment and machinery to be fully used so that its cost can be spread over as many units of production as possible. This is especially difficult to achieve on a great number of farms in Britain where some 80 per cent of all holdings are under 100 acres in size. Production grouping is an attempt to overcome this obstacle of relatively small-scale production, by enabling individual farms to operate as large businesses. In this way enterprises can be big enough to justify necessary heavy capital expenditure, and expensive machinery and buildings can become available to individual farmers at a fraction of the cost that would be involved if each individual farm was fully equipped.

Larger scale marketing

On the marketing side, there is the same need for scale of operation. The buyers of farm produce are now fewer in number and bigger in size than was the case 20 years ago. These buyers require produce of a definite quality that is regularly available in worthwhile quantities. It is difficult for thousands of farmers marketing independently to meet these requirements. Grouping has enabled farmers to increase the scale of their marketing operations so that they can employ marketing experts to seek out the best markets, inform members of the customers' requirements, and organize production so that these requirements can be satisfied.

Opportunities

The evidence of the large number of groups that are currently operating, is that co-operation at farm level, presents opportunities for farmers to cope with some of the problems of modern farming. Co-operation in production in suitable circumstances can be effective in increasing the productivity of labour and machinery and so reducing costs per unit. It can increase output by enabling the use of land, buildings and livestock to be planned to achieve large-scale enterprises; and it can enable production to be carried out to meet the requirements of the market. Grouping can also enable marketing to be carried on at a scale large enough to ascertain these market requirements, influence production so that these requirements can be met and provide the organization with which to sell the goods to the best advantage. The individual farmer must constantly make decisions about what he should produce, the method he should adopt, and how he should sell his produce. Grouping can relieve him of some of these responsibilities, so that he can concentrate on doing what he understands best.

Grants for co-operation

Grants are available under the Agricultural and Horticultural Scheme towards the costs of approved proposals for the co-operative production and marketing of produce. These grants are administered through the Central Council for Agricultural and Horticultural Co-operation at Hancock House, Vincent Square, London, S.W.1., to whom application for information and advice should be made.

The evidence of the past indicates that farmers can and will co-operate when they can see it is to their advantage.

There has been renewed interest in co-operation at farm level in recent years, resulting in the formation of production and marketing groups of various kinds. These groups have been formed because farmers recognized that by co-operating in this way they could cope with current problems of production and marketing better than by acting as individuals. These problems have arisen largely through the need for heavy capital investment for modern farm production and the changing market situation.

The experience of many of these groups is that co-operation at the farm level offers opportunities for reducing costs per unit, increasing output and achieving certain marketing advantages, principally by matching production to market needs.

This article has been contributed by **G. D. Salmon, B.Sc.,** who is Regional Farm Management Adviser for the National Agricultural Advisory Service in the Northern Region.

Colorado Beetle in 1966-67

During 1966, only five live Colorado beetles were found in England and Wales and this was probably the lowest annual total since the invasions early in the 1940s. Three of the beetles were on ships from Portugal, one with Italian fruit and one on a vegetable dump at Oldham Market. In 1967, there was a marked increase in the total to 35, but over half of this number was made up by one incident in Taunton where 19 beetles in a matchbox were pushed through the letterbox of the local office of the National Farmers' Union. Despite appeals on the radio, television and in the Press the person responsible was not traced. Of the remaining 16 beetles, five were from Portugal (three on ships, one with plums and one in a carton of blankets); three from Spain (one each on lettuce, onions and grapes); three from Italy (one on a ship, one amongst spinach and one in woodwool packing); one in a carton of dwarf beans from Belgium and one on a ship which had sailed direct from Canada and the Great Lakes ports. Two of the three remaining beetles were found on aircraft (one on a flight from Zurich to Gatwick via Jersey and the other on the Milan to Heathrow run); the third was in a car which had recently returned from Italy.

No breeding colony has been found in England and Wales since 1952.

Colorado beetle in Europe

The Reporting Service of the European and Mediterranean Plant Protection Organization keeps us informed on Colorado beetle in Europe. In 1966, the heaviest and earliest (19-20th May) Colorado beetle invasion ever observed in Denmark occurred on the southern islands of Lolland, Langeland and Alsen where thousands of live beetles were washed ashore, but they soon died. In Upper Austria, the first beetles were found as early as 6th May in the district of Eferding. In certain parts of Switzerland where conditions were favourable, spring beetles appeared early in May; summer beetles were seen early in July. Incidence in Switzerland during 1967 was low.

The watch for Colorado beetle is as important as ever, and the Ministry asks for the help of everyone to keep the pest out of the country.

H. W. Janson

Grass Drying

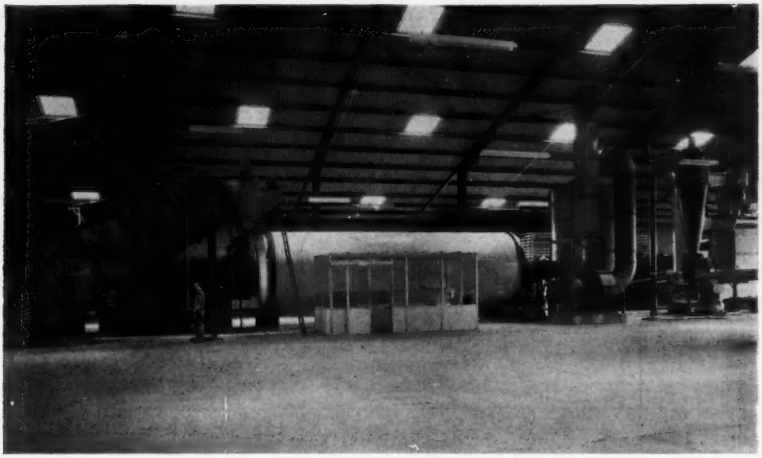
W. F. Raymond

MANY who remember the rise and fall in popularity of grass drying after the last war must wonder what has led to the present renewed interest, with forecasts in the farming press and on television of a revival of the industry. Do recent developments in crop production, in drying machinery and in livestock feeding really justify this revival of interest?

First, it is useful to consider why grass drying went out of favour 15 years ago. At that time about 1,000 driers were producing almost ¼ million tons of dried grass a year. However, most of the drying plants were small and rather inefficient, and needed much labour; crop yields were low and erratic, with a surplus of grass in spring—which the driers could not cope with—followed by a shortage of grass in midsummer, when many driers had to shut down; and much of the dried grass produced was of very low quality. When feedingstuffs were derationed in 1953, the majority of operators agreed with the economists that dried grass was not a competitive feed, and ceased production. Only the most efficient plants—generally the larger ones—continued, but producing a high-grade meal as a vitamin supplement for pigs and poultry, rather than a feed for cattle and sheep, for which the process was first introduced.

This was the situation a couple of years ago, when 100 drying plants were producing annually about 100,000 tons of dried grass—but this was a different industry from the 1950s. Crop yields had greatly increased with the use of better varieties and heavier manuring, and field harvesting machinery had improved. Even more important, operators were replacing obsolescent plant with a new 'generation' of drying equipment, operating at high temperatures (around 1,000°C) for maximum fuel economy, and highly automated to minimize labour use. This might have served only to make the existing industry more efficient, had it not coincided with two other developments.

Firstly, the need for an effective break-crop in cereal growing on arable farms was becoming more apparent. Grass and lucerne would be difficult to utilize without introducing new livestock enterprises, and an expansion of grass-drying might provide a new outlet for grass and lucerne as cash-crops.

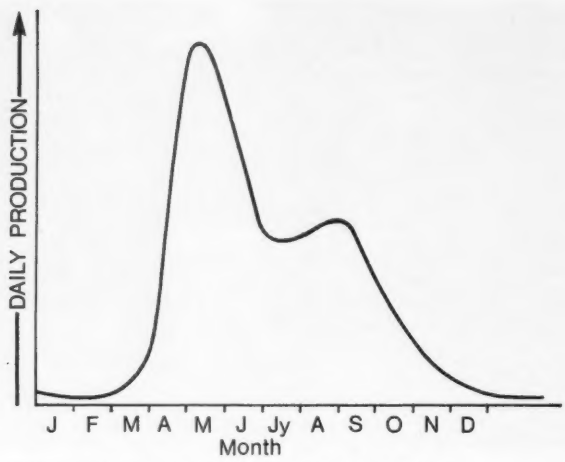


View of an erected drying plant

Cropping programmes

Secondly, research into ruminant nutrition had begun to 'rediscover' the high potential of dried grass for cattle and sheep. Woodman and Watson, in the 1930s, had shown that grass of high digestibility has a nutritive value close to that of concentrate feeds. Unfortunately much of the grassland management 15–20 years ago was not good enough to ensure that all the grass for drying was cut at the immature stage needed for high digestibility, with the result that much of the dried grass produced was of low quality—and quite unable to compete with purchased concentrates. This reflects a basic problem of grass drying as a method of conservation. Grass gives a peak yield in spring, lower production in summer, and a second peak in autumn (see diagram on p. 158), whereas the drying plant requires a steady supply of crop over a long season. *Because of this, grass drying cannot be looked on as an alternative to traditional conservation by hay and silage-making;* it needs a planned programme to give a succession of crops for cutting, and this is now more readily achieved because of the advances that have been made in crop production. Part of the secret of this is that we now increasingly talk about 'green-crop drying' rather than 'grass-drying', reflecting the use of crops other than grass for drying. This may develop further, because the modern drier can dry almost any kind of greencrop, including such 'unlikely' crops as wholecrop beans and forage maize. Certainly grass and lucerne are likely to provide the 'backbone' to cropping programmes; the sowing of different fields to early and late varieties of grasses, the use of spring-sown grass, and higher levels of fertilizing (particularly with N), can reduce the fluctuations in supply of crop as shown on p. 181. In spite of this, production is still likely to be too low at certain times, and the individual operator can then plan which other crops are needed to provide forage for cutting at these times—forage rye in November and April, whole-crop beans in July/August and forage maize in September/October are examples of such crops.

There are two reasons for such cropping programmes, the importance of a steady flow of crop to keep expensive equipment and skilled operators



Seasonal production of grassland in Britain

employed for as many days as possible, so as to minimize 'overhead' costs per ton of product, and the need to ensure that most of the dried crop is of high quality. Such programmes will be helped by new research information showing the changes in digestibility of different crops (grasses, legumes, cereals, etc.) as they grow and mature, from which the operator can predict when each crop should be cut to be at the required digestibility. Even with skilled management, however, some low digestibility feeds will be produced, and these can be allocated to stock, possibly breeding stock, that can make best use of them. Clearly the aim will be for the maximum proportion of high digestibility feeds, and for this planned cropping programmes will be essential.

Some costs involved

This need for a high degree of expert management points to the main development in greencrop drying being in large-scale units. This is reinforced by the fact that, as the size of the unit increases, there is a marked decrease in both labour and equipment costs per ton of dried product. To illustrate this it is useful to consider some of the costs involved in grass drying. It must be accepted that only preliminary costs can be given as few modern plants have operated long enough to establish firm costs; these must in any case depend on factors such as rate of amortization (is equipment 'written off' in 5, 7 or 10 years?), number of operating hours (2,000–3,500 hours per year), hauling distance of the cut crop—as well as rental values of land, fuel prices, etc. Estimates of the total production cost per ton of dried crop by three different sizes of drier, costed on a uniform basis, show clearly the economic advantages of large scale operation (see table).

While there may be improvements in smaller units, the more economical spread of both 'expertise' and 'overheads' in bigger drying units must, in general, give them an advantage. This then begins to define the likely scale of the drying enterprise. The output from a (medium size!) 2½-ton per hour drier operating for 3,000 hrs per year is 7,500 tons; at an average dried crop

production of 5 tons per acre this needs over 1,500 acres of land. This large acreage could be provided in three ways:

(*a*) from the large farm, or farming company;

(*b*) by contracting with neighbouring farmers to grow crops;

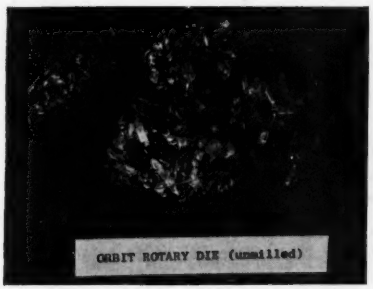
(*c*) by co-operative ownership, organized under the new Agricultural Co-operation Act.

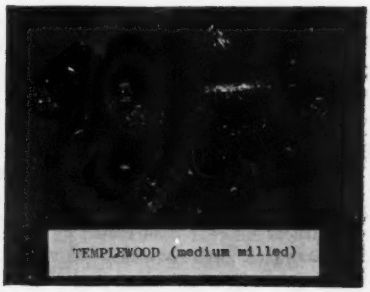
The first two methods will aim to sell most of the product, whereas co-operative drying groups are likely to retain a high proportion of the product for feeding to livestock owned by group members. All three will have similar basic features; large-scale equipment, planned cropping programmes and strong central management (not everyone considering co-operative drying has perhaps recognized how far the members must delegate decision-making to the drier operator).

These cost and efficiency factors will largely determine the price at which dried green-crops can be produced and sold; whether they are produced or *whether, in fact, grass drying will increase* will, however, depend on whether the products can compete with alternative feeds for cattle and sheep. It is on this aspect of dried grass that information is still lacking, partly because there are insufficient results from research or from practical experience, but also because of lack of agreement on feeding systems. This has raised the particular problem of the form in which dried grass should be 'packaged', for the product from the modern drier is short-chopped, and must be compressed into pellets or wafers to allow bulk storage and mechanical handling and transport. Where the aim is for dried grass to comprise most of the total ration, the feeding of pellets of hammer-milled grass may lead to digestive upsets; more seriously, dairy cows will produce milk of low fat content, because of a shortage of 'fibre' in the diet. Machines have thus been developed which compress dried grass into large wafers, up to 4 in. diameter, in which the staple-length of the material is maintained to provide 'fibre'; so far, however, these machines have not proved very satisfactory, and the wafers have had poor storage and handling characteristics.

Substitute for concentrates?

But can it be questioned whether dried grass *should* comprise most of the ration, or whether dried grass itself need provide the 'fibrousness' in the diet. All livestock enterprises in Britain have access to 'fibrous feeds' such as hay, silage or straw. These can provide the basic 'fibre' in rations, dried





grass then being used as a partial or complete substitute for the concentrate part of the ration. This is the role originally envisaged by Woodman and Watson; as well as high digestibility (energy), dried grass can have a high protein content, and so can balance low protein content in 'fibrous feeds' (this might reduce the need for high protein in silage, which makes silage-making more difficult). An indication of potential has come from the National Institute for Research in Dairying, where Connell reported that 5 lb of dried grass cubes (milled!) effectively replaced 4 lb of balanced dairy cubes, as a supplement to hay, during the first 20 weeks of the lactation of Friesian cows. Research in this direction is being extended, and will be widened by the experience of several farmers who are now trying similar systems.

In fact, present evidence suggests that the optimum package may be a fairly large pellet, produced directly from unmilled dried grass (to avoid the cost of milling), but containing a proportion of small particles which result from grinding in the die-ring of the press. Several such machines, now operating, could well provide the compromise between the requirements for animal feeding and for mechanical handling, which is needed if dried grass is to be a practical farm feed.

Conclusions

It must be emphasized again that there is still insufficient evidence for firm conclusions to be made on the economics of dried grass as a ruminant feed; such conclusions are essential before investment in an expansion of green-crop drying can be contemplated. But if this 'new' source of feed does prove viable, it could have important effects in many sectors of British Agriculture: in arable areas it may provide a more profitable use for break crops—grasses, legumes, beans, etc., and at the same time produce more nutrients per acre than even good cereal crops; these dried greencrops, together with barley, could then be transferred to livestock farms as supplements to basal rations of hay, silage and straw; or to hill areas, where the lower grades could be used as winter supplement to rough grazings. It is these possibilities that have led to the renewed interest in crop drying, and which justify the increasing amount of research on this system of land use and stock-feeding.

Approximate installation and operating costs of 3 sizes of grass driers*

	Rated output of drier, tons per hour		
	1	2½	5
Gross capital cost (Including drier, pelleter, building and stores, field machinery, etc.)	£50,000	£90,000	£160,000
	Summary of costs, per ton of output		
	£	£	£
Cost of growing crop†	5·75	5·75	5·75
Labour; harvesting and drying	5·0	3·2	2·7
Fuel oil, electricity and repairs	4·55	4·55	4·55
Amortization (7 years @ 9%)	4·0	3·0	2·5
Total	19·3	16·5	15·5

*Private communication from B. G. Jackson, School of Agriculture, Cambridge.
†Crop yield of 5 tons per acre; rental £12·5 per acre.

This article has been contributed by **W. F. Raymond, M.A. (Oxon), F.R.I.C.** He joined the Grassland Improvement Station in 1945 and from there helped to establish the Grassland Research Institute at Hurley, and is now a Deputy Director of that Institute.

High quality grass for silage

Silage

in Beef Production

J. M. Willcock. *Director, Liscombe Experimental Husbandry Farm*

CONSERVATION is inherent in grass and livestock production in this country. The main peak of seasonal output from grassland occurs during May and June. This is followed by a trough during the summer months and a small peak in the autumn. Conservation serves a dual role—to provide fodder for the winter and as a tool of grassland management where grass surplus to grazing requirements is suitably conserved so as to marry grassland production with animal requirements.

Grass can either be dried naturally or artificially or conserved as silage. There is little conflict between methods of conservation, the processes are complementary rather than competitive. Each method has advantages and disadvantages. Of more importance is how either or all methods fit into a particular farming system. Quality is relative and depends on a number of factors. However, a natural law is that conservation will not improve the quality of the feed; it is not possible to take out better fodder than was put in. This article is based on the experience gained at Liscombe Experimental Husbandry Farm where a large number of studies on silage-making and feeding have been undertaken over the years.

Quality

The performance of beef cattle on silage diets can vary from barely maintaining live weight to gaining at 2 lb live weight per day. The work

at Liscombe has shown that in beef production both type of silage and the type of animal must be considered. It is not necessarily desirable to attain high performance and there can be a place for silages of various qualities, depending on the overall farming system.

Firstly the silage. What is taken out of the clamp starts in the field as growing grass. Feeding value of first-crop silage depends to a large degree on the leafiness and the earliness of the crop when cut. Different varieties of grass mature at different dates and these vary considerably. For example, in an early season commercial varieties of perennial ryegrass run to head at the beginning of May, compared with say, S 23 perennial ryegrass which does not reach the same stage until a month later. Earliness of cutting is related to date of heading and for silage of good quality, capable of giving maintenance and from 1 to 1½ lb live weight; making should be completed by or before any flowering heads can be seen. This in a mixed sward would mean silage-making during the second part of May. Experience at Liscombe has shown that by delaying cutting until mid-June only maintenance or maintenance and up to half a pound of liveweight gain is produced. It is true that as the result of delaying cutting the yield of herbage has increased by about one-third, but this has been at the expense of high-quality aftermath.

What has been written so far refers to the first crop of the growing season. Good quality silage can be made from aftermath growth or from swards which have been grazed until after the date when the grass varieties run to head. In many farming situations this fits in well with the overall management. For instance, all the spring crop can be grazed by forward stores to finish off grass in early summer before beef prices fall. Or, cattle moved from highly-stocked spring pastures on to aftermath of first-cut silage, the spring-stocked pastures then let up for summer or autumn silage, thus reducing the soiling problem. This also helps to spread the silage-making season. There are two important points about this practice. The first is that although aftermath silage can be of good quality it is seldom as good as first-crop silage cut really early. It is, however, likely to be far superior to late-cut first-crop silage. The second point is that aftermath silage, and this applies particularly to late-autumn silage, tends to be wet because shortening days and heavy dews make wilting more difficult.

Another factor affecting the performance from all silages is the dry-matter content. With silages cut at the same time, cattle will consume a greater quantity of nutritive material with a 'dry' silage than a 'wet' one. Hence, if it is possible to wilt the crop this will result in a better quality silage. However, experience would suggest that it is an advantage to wilt but not to hold up silage-making by waiting for an elusive wilting period if it means delaying cutting, as there is a danger of getting an improvement in dry matter but a big drop in digestibility and hence feeding quality of the silage.

Conventional silage-making

Efficient ensilage depends on the production of lactic acid which acts as a preserving agent. The bacteria producing it, feed on the natural sugars in the grass. Cutting a young, leafy crop especially if liberally fertilized with nitrogen, results in low sugars which can be compensated by the use of 'additives'. The early cut silages at Liscombe have molasses added to produce a good fermentation. In this connection wilting, when possible,

does help the fermentation and can reduce the need for molasses. A quick rate of work helps exclude air and reduces the respiration time when the cut grass is slowly dying. Having got the right type of grass in the silo, then rolling well to consolidate followed by covering with polythene sheeting will ensure silage of good fermentation with a minimum loss.

This is conventional silage-making using the right type of crop. In recent years there has been considerable interest in vacuum silage. Work at Liscombe shows that the vacuum process does not reduce the normal losses of nutrient material which occur in silage fermentation. It can, however, reduce the visible waste on the outside provided the vacuum sheets do not get torn. On balance very nearly as good a job can be made in a carefully-filled, conventional-walled and roofed silo and there is not the bother with sheets, seals and vacuum pump at a busy time of the year. Vacuum silage may, however, have a place when small parcels are made or when it is desirable to add small quantities of surplus grass to an existing clamp. The process can be very useful when silage with a high dry matter of 30 per cent or more is made, but care is necessary when feeding such very dry silage if secondary fermentation is to be avoided.

Feeding

A record of the time each parcel of silage was made, together with the details of conditions at making, an estimate of dryness or wetness and an analysis, all help in deciding how and to what class of stock to feed the silage and what level of supplementation will be necessary.

With the spring-calving suckler cow, silage quality is not so important for she can generally make up in quantity what is lacking in quality. With the autumn-calver, quality is more important and can mean the difference between a good winter milk supply or the need for concentrates. It is with the younger beef fattening or store animal that silage quality is critical. An interesting feature in silage feeding which has been observed on a number of occasions is that the method of rearing has some effect upon a beast's ability to consume silage. It has always been noticed that artificially reared beef-cross Friesian steers, which have been reared at grass, grow much better during the winter than single-suckled, beef-bred steers. Looking at the problem more closely it was found that both the beef breeding and the single suckling were causing this disappointing performance. Single-suckled, pure beef calves were gaining at less than half the rate of the grass-reared, beef-cross Friesian. It appears that the method of rearing affects the animals' intake during the first two months of winter feeding. The suckled animal eats less silage as compared with the grass-reared calf which has developed a larger capacity as a result of grass rearing. Also the beneficial effect of some Friesian blood in the animal to give greater growth potential is noticeable all winter. It seems that the pure beef suckler is less suited to silage feeding than a cross-bred suckler and an even better type of animal is the grass-reared beef-cross Friesian. With this latter type animal, a decision is necessary before winter feeding starts on whether to aim at fattening before the end of the winter or winter through as stores and then fatten off grass the following summer. The young 5 cwt fattening animal has to gain weight at about 2 lb per day to flesh well and fatten by the end of the winter. Quality of silage shows up well here. With 5 cwt Hereford x Friesian

steers the Liscombe results showed that an earlier cutting of silage meant a saving of fattening concentrate. Taking the winter as a whole, animals fed silage cut in mid-May ate 1½ cwt/head more silage dry matter (equivalent to approximately 5 cwt more wet silage) but used 1·4 cwt less concentrate and were 20 lb heavier at slaughter than those fed silage cut in mid-June. The financial benefit from the earlier made silage was £5 per beast. A similar finding occurred with animals stored through the winter. Using store diets of silage alone or with 3 lb of barley there was a saving of £3 per head when the stores had been finally fattened off grass. In neither the fattening nor store system did wilting have much effect, the main reason being that the degree of wilt possible at the time of making was not sufficient to improve the amount of silage eaten. An interesting aspect in winter store feeding of young cattle which arose from these and other trials is that the optimum winter liveweight gain is around ¾ to 1¼ lb per day. If the rate of gain is below this range, then few cattle will be fit before the price fall which occurs in the following autumn. Very probably a percentage will need a further period in yards before being fit for slaughter. On the other hand cattle which have made higher gains through the winter will suffer a greater check on turn-out and rarely do as well at grass as those wintered on a moderate plane.

Rate of gain from a given quality silage does increase with age of beast. Higher individual daily performance, therefore, usually occurs during the second part of the winter. Also higher gains are achieved by older cattle than with young cattle but, of course, due to their greater weight, they do eat more silage. An important grass-beef system is the production of eighteen-month beef from autumn-born calves. The viability of such a system depends largely on performance at grass and the amount of concentrate necessary in the winter finishing period. Although it is possible to finish cattle on a silage only diet the quality has to be so good that it is doubtful if in farm practice this could be achieved consistently year after year. It would appear, therefore, that a level of concentrate feeding is necessary to ensure winter finishing and a good quality carcass. However, in trials with good quality silage and levels of concentrate feed, margins decreased by 10*s.* to 20*s.* for every extra pound of concentrate used per day. It is obvious that if the price of concentrate continues to rise, it will be even more important to replace concentrate feed by high quality conserved fodder.

Experimental Husbandry Farms

The series of articles from the Ministry's Experimental Husbandry Farms will continue in 'Agriculture' throughout the year.

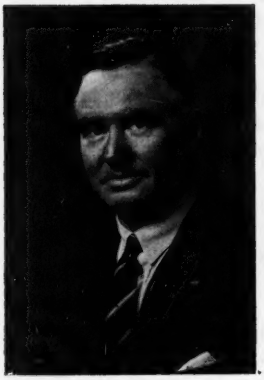
Among the subjects it is hoped to cover are:

Grassland in Arable Farming

Feeding Sows

New Studies in Calf Housing

Some Thoughts about Large Cow Units



Disposal of Effluent from the Piggery

D. S. Soutar S. H. Baxter

IT has been forecasted by pig housing authorities both in Europe and America that in the near future the dung and urine produced on most pig production units will be handled in sludge form. This implies the adoption of management practices which require little or no bedding. This article concerns the handling of pig effluent in sludge form.

Design and management of pig pen

The pig is an animal of naturally clean habits, choosing, wherever possible, to dung and urinate away from its bed. The farmer has for a long time made good use of these natural traits and pig pens have been so designed as to encourage the pigs to deposit their dung and urine where it can be most conveniently handled. To do this, certain design dimensions and management practices must be observed. These include ease of access to dunging areas (which should be well lit), the placing of the water bowl in the dunging area and other now widely accepted practices. The warming of the floor farthest from the dunging area by electric elements or hot-water pipes is a relatively recent innovation to encourage pigs to recognize and respect the bed area as opposed to the dunging area.

Sludge effluent systems and bedded pens

The adoption of a sludge system generally implies a no-bedding system of management, in order that the mobility of the sludge can be maintained and so simplify its handling. However, such are the apparent benefits of bedding to good husbandry in farrowing and rearing pens that some farmers insist on bedding at farrowing, rearing and weaning stages, although they are quite happy to forego bedding for the later stages of production. The general adoption of high insulation standards in the construction of piggery floors has done much to reduce the need for bedding, and the installation of floor warming is a further benefit towards this end.

Limited quantities of sawdust and shavings can be handled in a sludge system when final distribution of the sludge on the land is to be carried out by vacuum tanker, but both these materials will readily cause serious blockages in a piped irrigation system. Recent experiments in Holland involving pigs from weaning to bacon stage showed certain beneficial results when using bedded pens with a step up and a step over board division, which effectively prevented the straw bedding from being trailed on to the slatted dung area. However, preliminary results of a similar trial at the North of Scotland College of Agriculture show no economically significant difference between bedded and non-bedded floors.

Warning may be given here that bedding of any form in the sludge is likely to alter the consistency and, consequently, can reduce the efficiency of the system.

The practice of having clearly defined dunging areas is becoming less common where slatted dung areas are involved as the pigs will lie perfectly happily on the slats. The most important factor is to ensure a sufficient overall floor area of which an ample proportion is slatted.

Space forbids detailed discussion on dunging area requirements as these depend on a considerable number of factors such as the class of pigs involved, numbers of pigs per pen, pen design, etc.

Sludge storage requirements and methods

The storage requirements of any effluent handling system will depend on many factors—the class and number of stock to be served, the type of feeding, the dilution rate considered necessary and the frequency of emptying. Meal-fed bacon pigs produce approximately 1½ cu. ft of dung and urine per week, but in a system serving pigs from weaning to bacon an average allowance of 1 cu. ft per head per week may suffice. Skim or whey-fed baconers may produce up to 4 cu. ft per week.

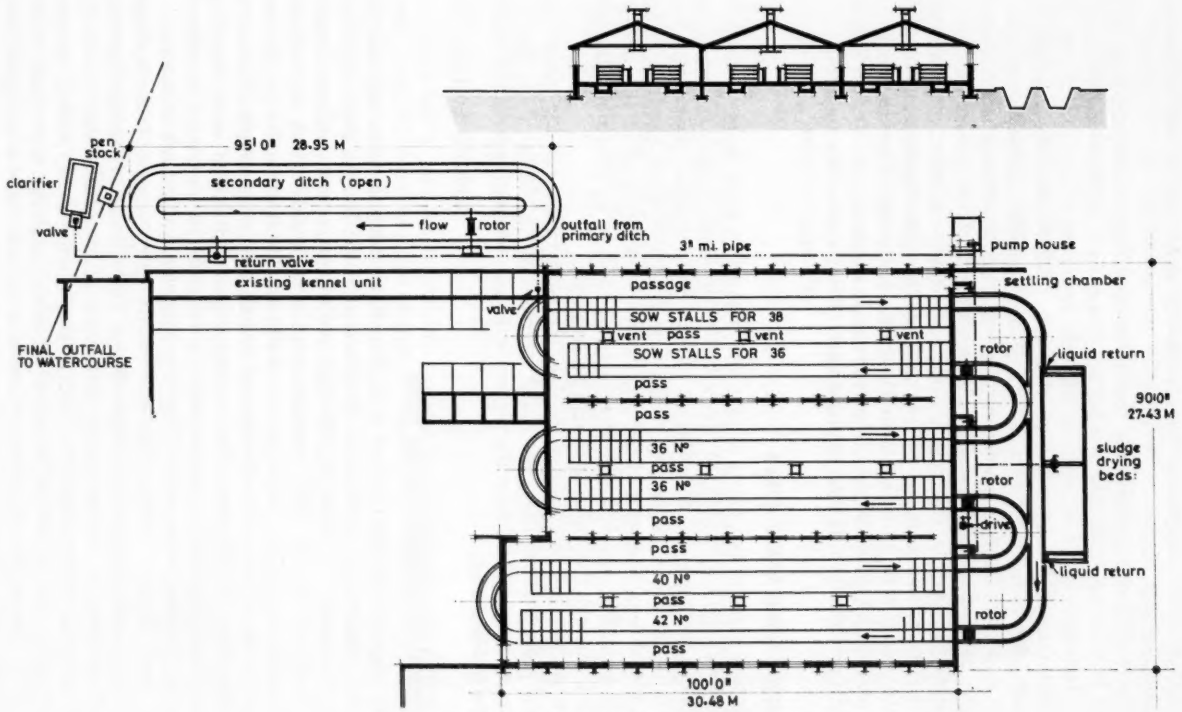
Sludge may be stored in a chamber under the slatted dung area or fully slatted pen or in an end or central holding tank serving one or more piggeries.

In the north of Scotland it has been customary to form a cellar under the slats for sludge storage, often combining such areas of adjacent pens to form a large cellar with a central draw-off point for a vacuum tanker. Where such a form of storage is used the actual piggery design may have an over-riding influence on the capacity of the storage chamber.

The capacity of storage tanks outside the piggery building should be designed in relation to the frequency of emptying. Where each piggery is to be provided with its own holding tank, for simplicity in management such is generally built to allow gravity filling from the piggery sludge channels. Where the effluent from a number of piggeries is to be run to a central holding tank the cheapest storage is probably a shallow, polythene sheet-lined pond costing 1*s.* to 1*s.* 6*d.* per cu. ft. Above ground tanks from 4*s.* to 5*s.* per cu. ft are more economically attractive than underground tanks from 10*s.* to 12*s.* per cu. ft even though pumping or elevating equipment is then a necessary extra.

Sludge conveyance

Having so designed the pens that the pigs deposit dung and urine in a specific area, and having decided on the form of storage, the question arises as to how to convey the sludge from the former to the latter.



Dry sow stall house with oxidation ditch sludge disposal

While on purely economic grounds in many circumstances the manually operated 'squeegee', used to push dung to tank inlets, can claim advantages over the other systems, the degree of unpleasant manual labour involved is unlikely to be accepted in the future. The same may be said of tractor-mounted scraper blades.

Where slatted dunging areas require an under-slat conveying channel it must be watertight and laid to a fall not exceeding 1 in 100 with a watertight end sluice gate which is raised for periodic emptying of the channel into the holding tank. For economy in construction, channels can be rectangular in section. Where the dung area is more than 4 ft wide a sub-dividing 'spine' wall should be built to form two narrow channels. The channels should always be flooded with water to a minimum depth of 2 in. before use.

Sluice gates can be made up in various materials—wooden gates in metal guides *vice versa* and metal gates in metal guides—preferably set at an angle to the sludge flow to assist in making them leakproof. They should be of simple design and should certainly not exceed a dimension of 3 ft $\times$ 3 ft and a weight of 50 lb for one man operation or 150 lb for two man operation.

Danger from toxic gases

Recent cases of poisoning of pigs and pigmen by toxic gases (principally hydrogen sulphide), which are released when the sludge is agitated, are giving pighouse designers cause for serious thought as to whether current practices are safe—let alone satisfactory. Great care is advised when handling sludge which has been undisturbed for one or two weeks because of this danger. Stock should be removed from any pens that might be affected and maximum airflow through the building should be arranged.

To counter possible gassing troubles the Norwegians run the sludge out of the piggery at regular (even daily) intervals via an airtight sluice gate or a trap so as to seal off from the piggery any gases emanating from the sludge in the holding tank.

Disposal of effluent on the land

As piggery effluent requires a minimum of dilution when handled by vacuum tanker this method of distribution on the land is most common. This equipment has been greatly improved of recent years and can handle pig sludge of a very 'stiff' consistency at a most satisfactory rate. Under certain circumstances a case can be made out for distribution by pipeline irrigation in preference to the vacuum tanker, but space prevents discussion on the subject in this article. The loading of land with sludge varies according to local soil, climatic and other conditions including the degree of sacrifice of growth potential which may be made to accommodate effluent disposal.

A novel disposal system which involves the daily pumping of fresh sludge on to a contour-ploughed sloping field on a Yorkshire farm has been showing great promise, as well as having the praise of the local River Authority. The sludge is pumped out by a high pressure screw pump with a hammer mill to deal with the solids. Whenever possible the sludge is pumped 'round the farm' but during the grazing season a 60-acre contour-ploughed field is loaded with up to 40 tons of slurry per day.

In areas where straw is very plentiful sludge is sometimes pumped on to straw heaps which are built up and form a compost which can be readily

handled by normal farm equipment for field distribution as and when required.

When spread on the land pig sludge which has been stored for any period exudes a heavy pungent smell which might be considered a public nuisance. Therefore, if such operations are being carried out adjacent to habitation or public places the use of a commercially produced deodorizer should be considered.

Other disposal methods

The situation is arising with increasing frequency wherein effluent disposal on adjacent agricultural land is impossible either because the land is not available or because sludge distribution on it is impracticable. This is unfortunate, as irrespective of the often-debated manurial value of pig sludge, nearly all alternative disposal methods are more expensive.

Neighbouring farmers may dispose of the effluent either for its own value or for a small charge, contractors will quote for such a service while a costly and seldom used method is the disposal by sewer on a not inconsiderable payment to the local authority.

Lagoons

The disposal of piggery effluent into self-consuming sludge lagoons has been practised widely in America with varying degrees of success or failure. Aerobic lagoons require to have a surface area of one acre per hundred pigs. Anaerobic lagoons can deal with the effluent of 3,000 pigs per acre but the smell that may arise can cause serious trouble. Such can be the nuisance value of these lagoons that certain States in the U.S.A. will not sanction their construction. In Britain the self-consumption lagoon is a rarity but at least one has been in operation for five years and is giving every satisfaction.

Oxidation ditches

There are a number of aerobic systems for the treatment of domestic and trade effluents but these tend to be expensive by agricultural standards. In the Netherlands, however, Dr. A. Pasveer has developed an oxidation ditch for small rural communities which is relatively inexpensive, both in capital outlay and running costs, and this principle is being successfully applied to the treatment of piggery wastes by Dr. H. Scheltinga of the Agricultural Waste Water Institute at Arnhem. The piggery involved comprises 160 pigs in pens with slatted dung areas and from these the sludge is pumped daily to a simple above-ground continuous ditch round which the sludge is moved by an electrically powered rotor. The results have been successful and the final effluent is suitable for discharge into an adjacent roadside ditch.

Inspired by the Pasveer ditch, but ignorant of the Scheltinga developments, Muir of Pert Farms Ltd., Tealing, Dundee, erected an experimental fully slatted floored feeding piggery with a continuous ditch under the slats wherein the sludge was circulated by an externally mounted rotor, the treatment being extended in an adjacent ditch alongside the experimental house. While various troubles were experienced and while the resultant final effluent fell short of River Board standards, the results were sufficiently promising to warrant the construction of a 228 dry sow stall house (plan on

p. 167) and a 600 pig feeding house both of which involve sludge treatment by the oxidation ditch system. These two houses are now in their first year of use and are showing considerable promise. It should be noted that some aspects of the oxidation ditch system are covered by patents.

The Americans have shown considerable interest in oxidation ditch treatment of pig sludge and probably over 100 piggeries so equipped are in use. However, it is reported that the elimination of obnoxious odours which emanate from pig wastes is regarded with as much importance as the treatment and disposal of the wastes.

In fairness to all concerned it must be emphasized that the oxidation ditch treatment of piggery effluent must be the subject of considerable further research before such design data is available that will enable the commercial producer to be supplied with a reasonably foolproof system. Furthermore, it may well be that the most economic system may involve partial treatment in an oxidation ditch and final treatment by distribution on a limited area of land set aside for this purpose.

Conclusion

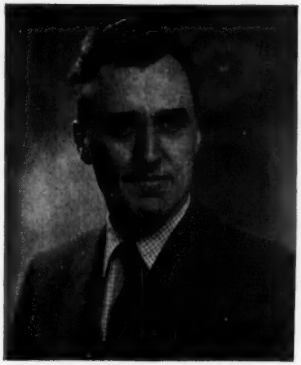
While ever-increasing intensification of pig production emphasizes the need for the production of economic systems of effluent treatment without resort to the use of large arable acreages, at our present state of development properly organized field distribution of sludge, where possible, may offer the most satisfactory answer.

D. S. Soutar, A.R.I.B.A., A.A. (Hons.) Dip., F.R.I.A.S., C.I.Agr.E., is Head of the Scottish Farm Buildings Investigation Unit, North of Scotland College of Agriculture and was co-founder and past Chairman of the Farm Building Association. His co-author **S. H. Baxter, A.R.I.C.S.,** is Senior Investigator at the Scottish Farm Buildings Investigation Unit. When qualifying in 1962 he won the Driver, John Gilchrist, Building Construction and College of Estate Management Prizes.

Statutory Smallholdings – Final Report

THE Report, entitled 'Departmental Committee of Inquiry into Statutory Smallholdings—Final Report: Statutory Smallholdings provided by the Ministry of Agriculture, Fisheries and Food' (Cmnd. 3303) is published by Her Majesty's Stationery Office, price 18*s.* 6*d.* (Addresses from where the publication can be obtained are on page 198).

The Report deals with statutory smallholdings provided by the Ministry of Agriculture, Fisheries and Food. These consist of some 800 small intensive holdings on 18 estates which are managed for the Minister by the Land Settlement Association and about 240 smallholdings on three estates, known as Farm Settlements, which are managed by the Ministry's Land Service.



Spraying Cereals

Stanley Evans

ESTIMATES made 20 years ago of the effects of spraying cereals for the control of annual broad-leaved weeds suggested substantial yield impovements of 20 per cent and more. The general belief that spraying readily improves yields has contributed to the widespread acceptance of herbicides and the spraying of cereal crops has for some years been a routine matter on many farms. A study of results of experiments published 5 to 10 years ago, on the other hand, showed that the extra crop yield from spraying was, on average, less than 2 per cent.

During the period 1965 to 1967 the N.A.A.S. carried out an investigation to find what yield improvement farmers were actually getting from spraying. Information was gathered from over 300 fields, sprayed for broad-leaf weed control in which one or more strips were left unsprayed. Nearly two thirds of the sites were on spring barley and about a third on spring or winter wheat. Farms were generally chosen where a high proportion of the arable acreage was in cereals and where herbicide spraying had been a routine for many years. The preponderance of sites was in the drier eastern parts of England:

Region	*No. of fields*
Eastern	135
South Eastern	84
East Midlands	35
West Midlands and South West	40
Northern	10

An analysis of the yields recorded from the sprayed and unsprayed areas showed that on average there was no direct loss in yield from withholding spraying for one season. Not only was the average effect of spraying nil but analysis shows that there can have been very few individual fields where spraying gave any worthwhile yield increase; there were equally few fields where it had an adverse effect. To justify spraying then it seems that either (a) a greater yield response to spraying must be obtained or (b) some other benefit must be considered worth the expense of spraying.

Factors influencing yield response

The change in yield from spraying is a result of opposing influences: the beneficial effect of removing weeds and a possible adverse effect of the herbicide on the crop.

The records of the fields in the investigation showed that broad-leaved weeds were often not very dense. A quarter of the sites had 5 seedlings or less per square foot at the time of spraying and another quarter between 6 and 10 per square foot. Rather less than a quarter of the sites had more than 20 weeds per square foot. The most important species was undoubtedly chickweed (*Stellaria media*). This was mentioned at about a third of the sites as being a predominant weed. Next in importance, but mentioned only half as frequently, was knotgrass (*Polygonum aviculare*). Then came speedwell (*Veronica* spp.), black bindweed (*Polygonum convolvulus*) and charlock (*Sinapis arvensis*). At about a tenth of the sites fat hen (*Chenopodium album*), mayweeds (species generally unrecorded) and redshank (*Polygonum persicaria*) were said to be important. Cleavers (*Galium aperine*) were important at about one site in twenty with a tendency for it to be more frequent in winter wheat than spring crops.

The comparative ability of different weed species to depress cereal yields is in general unknown although limited studies have shown that the effects of various species can be very different. It is not possible then to categorize the importance of the main weeds shown up in the investigation. One can only pose the question: are these weeds generally important in competing seriously with crops, particularly at the rather low populations recorded in many fields? If they are not, then their removal cannot be expected to lead to major yield increases.

If on the other hand the weeds are detrimental to crop yield there must be some factor preventing the crops benefiting as well as they might from the removal of weeds by sprays. Three will be considered here—the time of spraying, the correctness of the treatment and the accuracy of spraying.

There is much experimental evidence to show that early weed removal is important. Spraying when the crop is at the 3–4-leaf stage generally produces distinctly better yields than spraying at the 5-leaf stage or later. Nevertheless, something in the order of half the fields in the investigation were sprayed at the later stage.

The susceptibility of cereal crops to herbicides depends primarily upon the dose of herbicide and the stage of growth at which it is applied. The most resistant stages and the maximum doses are well defined. There were however a surprisingly large proportion of fields in the investigation—about a third of them—where application was incorrect. The main faults were incorrect timing or dose.

In addition to errors in treatment must be added errors in the spraying operation itself. Supplementary information was obtained on the precision with which fields were sprayed and this will be published elsewhere. Bad spraying was not uncommon. The calibration of some machines was grossly inaccurate, the output of nozzles on the same machine sometimes varied widely and booms were set to the incorrect height. It is not surprising that spray distribution has been very uneven on many fields. Clearly machine maintenance and operation need improvement.

It is unreasonable to expect good results from incorrect treatments and poor spraying. In order to obtain the most benefit a correct and early treat-

ment must be properly applied. There is nothing new in this statement but it seems that up to now many farmers have paid insufficient attention to such advice.

Other reasons for spraying

One of the main reasons for spraying these days seems to be that of easing the harvesting and storing of the grain. In the investigation no crop remained unharvested because of weeds but there was often a greater time taken up in harvesting the unsprayed plots. Delay of this nature can be important. Losses in crops allowed to stand beyond the fully ripe stage may be appreciable. Greater weed contamination of grain from the unsprayed crop was also noted and this too can be of significance in storing or selling the grain. The importance of weeds at harvest time however is again related to the weed species concerned and also to the capacity of the combine harvesters and grain cleaning and drying facilities.

The results of the investigation suggest that farmers ought to be more critical of their spraying programme for cereals. They should consider carefully the desirability of spraying any particular field, and, once spraying has been decided upon, the operation should be timely and accurate.

An aspect which is not clear and would seem worthy of investigation is the consequence to weed populations of not spraying. Changes in weed species and numbers under various regimes of spraying have not been studied. The influence of weed control in cereals on weeds in subsequent crops must not be overlooked.

Acknowledgements

The investigation reported briefly here was conducted with the help of many members of the N.A.A.S. and the Statistics Department of the Rothamsted Experimental Station to all of whom thanks are due. A fuller report will appear in 'Experimental Husbandry'.

This article has been contributed by **Stanley A. Evans, B.Sc., Dip.Agric.,** who is the N.A.A.S. Liaison Officer with the Agricultural Research Council's Weed Research Organisation at Kidlington, near Oxford.

Animal Diseases 1967

Detailed information on the outbreaks of animal diseases in Britain during 1967 is given in the Statutory Return of Proceedings under the Diseases of Animals Act 1950 for the year 1967, which is published by the Ministry of Agriculture, Fisheries and Food and the Department of Agriculture and Fisheries for Scotland. Copies are obtainable from H.M. Stationery Office or through booksellers, price 1*s.* 0*d.* (by post 1*s.* 3*d.*). A comprehensive report, which will include details of the work of the Laboratory Research and Investigation Services, will be published later.

Middle belt in shape of Manx leg at 800 ft at the College Farm, Aber

Shelter Research

R. G. A. Lofthouse

TREES are a distinguishing feature of the British landscape, whether they are clumps in a London park, Sussex woods folded in the Downs or one of the large forests of the northern or western hill areas. They soften the appearance of the countryside, increase its aesthetic appeal, and afford protection for animals and birds, so encouraging wild life and improving sporting. All these attributes commend woodland to us and indeed we cannot think of a country scene without its trees; British landscape painters have taken full advantage of this and trees feature prominently in their compositions particularly in association with clouds and wind. Trees affect the ecology of the countryside in affording protection against the full force of the wind; so do, of course, hedges, walls, hurdles and other artificial screens. Shelter effect is therefore obtained from many kinds of barriers, ranging from the large forest tract to the netting or hurdles around a patch of vegetables. In his vivid phrase, 'tempering the wind to the shorn lamb', Sterne not only appreciated the harmful effect on young creatures of exposure to unwelcome winds but, perhaps unconsciously, was also being technically accurate in seeming to recognize the need to temper the wind rather than attempting to block its path altogether. Experts are agreed that the aim of shelter for crops and livestock, as well as the copse which shelters the exposed farmhouse, should be to slow down the force of the wind by erecting a permeable barrier in its path rather than a closely knitted, near-solid block which would create harmful wind-turbulence at each end and on each side at different distances from the barrier.

Need and benefit

Shelter is an effect created by an ameliorating influence on the climatic exposure of a particular situation. It may sometimes be better not to attempt to interpose shelter against the prevailing wind, which in these islands is predominantly south-west and therefore often mild; shelter may be needed against the cutting east wind which is harmful to livestock and crops—and indeed humans. The forest tract, although planted primarily for timber, increases the amount of topographical shelter; an afforested countryside slows the wind and offers sheltered tracts to a greater extent than a bare and treeless area over which the raw wind sweeps unhindered. Moreover, as Lines has put it: 'The economics of establishing shelter-belts dictate that on hill ground blocks are superior to narrow belts'. It will be interesting in future years to see what effect the intensive plantings undertaken by the Northern Ireland Ministry of Agriculture's Forestry Division in the Beaghs Forest area of Co. Antrim, established under the difficult conditions of soil and climate of Northern Ireland, has on improving the grazing capacity of nearby hill areas. These extremely exposed sites of wet peat bog at about 1,200 feet in elevation must be about the critical limit for successful forest growth but if successful—as they promise to be—they will become a great national asset from the point of view of amenity, shelter and timber supply.

An attempt to measure the amount of shelter afforded by the natural topography of an area and the extent to which livestock, especially sheep, use it has been made at the University College of Wales, Aberystwyth. This work has concentrated on devising methods of assessing exposure and the needs of the grazing animals; also observations have been made on sheep behaviour in relation to topographic and artificial shelter under a range of upland conditions which it is hoped will allow recognition of critical conditions under which livestock seek shelter. An important incidental to this work has been the study of the reliability of the tatter flag as a means of assessing exposure. The flag has emerged, by its rate of tatter, as a reasonably reliable indicator of wind exposure, and taken together with climatic records, is a useful research tool and offers valuable results. Other examples of the topographical benefit of shelter planting may be drawn from very different localities. There has been extensive and thoughtful shelter planting to temper the effect of a cold east wind on H.M. the Queen's estate at Sandringham and these woods add significantly to the amenities of the district. By contrast, in Northumberland, successful planting for shelter as well as timber can be seen on the Ray Estate, near Otterburn, and on the Duke of Northumberland's Emblehope Estate where there has been a deliberate policy of planting to provide shelter, grow good timber and at the same time minimize encroachment on hill farms by careful selection of the areas planted after consulting shepherds. This is true integration of forestry and agriculture and, incidentally, enhances rather than diminishes the beauty of a countryside designated as a National Park.

Shelter planting can be linked with improvement of amenity and the preservation of sea defences. In some coastal situations, trees, usually pines, not only afford shelter to nearby fields but help to stabilize sand dunes and so protect them from erosion by the sea, by wind, and, not least, by the wearing effect of people walking to the beach.

Sometimes farmers near the coast have sought to protect their crops by providing some form of shelter from on-shore salt laden winds; for example,

a carrot grower by the sea at North Berwick sheltered his crop by narrow strips of sea buckthorn supported by four-row conifer belts, with rewarding results.

Management and maintenance

The University of Edinburgh, with a grant from the Agricultural Research Council, have been investigating the influence of shelter on the growth and production of pasture and field crops including turnips and sugar beet, and are also carrying out a survey to observe the deterioration of shelter-belts on the Lothians, Peebleshire and in areas of Lanarkshire bordering on the Pentland Hills. This deterioration presents a serious problem and serves to emphasize the need for a deliberate policy of continuously managing shelter-belts as such from the moment they are established. Where this has not been possible because of a change of ownership or responsibility, the problem is how to manage by selective felling, pruning and underplanting to re-establish the belt as an efficient shelter barrier.

To create a more local shelter effect, perhaps as benefit to an upland hill-intake or an exposed group of lowland fields, plantings on a smaller scale than the forest tracts have been made which are intended to be managed and maintained as permanent shelter-belts or clumps. The value of this type of shelter has long been recognized in this country and we have only to open our eyes and look around to see shelter-belts and woods planted years ago; some, alas, since neglected or unsuitably managed. In the last twenty years, shelter planting on this scale has been the subject of revived interest. Grants are available from the Ministry of Agriculture, Fisheries and Food, and the Department of Agriculture and Fisheries for Scotland, under the Hill Land Improvement Scheme, the Farm Improvement Scheme and the Horticulture Improvement Scheme, toward the cost of planting shelter. Grants have so far been paid out on some 600 acres of shelter-belts planted by about 450 applicants. No doubt, many more have been planted without any financial assistance from the State.

The shelter provided by forests, woodlands, belts of trees, hedges and stone walls, generally meets the needs of agriculture. But for the special conditions of horticultural crops, small-scale artificial barriers of timber, slotted hardboard, plastic mesh or even hessian may be what is required. These artificial barriers, which have already proved their worth, have the great advantage that they can be erected quickly and moved fairly easily. The work of Shepherd and Hogg at the Rosewarne Experimental Horticulture Station, on the shelter needs of vegetable crops, the ways of providing this, and the measurement of plant response have been of particular benefit to the grower. The determination of the ratio of 40: 60 open/solid area of screening to achieve optimum shelter from artificial screens is but one example. The reader is referred to the *Shelter hedges and trees: Summary of Experimental Results 1953–1963* Rosewarne Experimental Horticultural Station, copies of which are obtainable from the Director.

Pertinent questions

Anyone contemplating providing shelter, particularly in the agricultural field, will find that some fundamental questions have not yet been completely answered. What is the optimum size and shape of a shelter-belt? How should

its dimensions be determined in relation to the area to be protected? How should it be sited to soften the worst weather conditions? What trees should be used for the belt in different situations of altitude, soil and climate? Are the effects of a proposed shelter-belt likely to be worth while and when will its earliest effects be felt? Most important, will its benefit justify the initial expenditure and subsequent maintenance costs? Attention has been given to some of these questions. An interesting experiment starting with newly-planted shelter clumps of different shapes, both rectangular and Manx-legged, began some years ago on the hill land belonging to the University College of North Wales farm at Aber, near Bangor. Several studies have developed there under the general description of an inquiry into the effect of introducing natural shelter for the first time on hill land where a flock of hill sheep have been established for many years. Three main lines of study currently being made are sheep behaviour and performance on the hill including the effect on sheep of different levels of food intake, more detailed meteorological observations on certain features of the hill or ffridd and ecological studies of the pasture to determine the effect of shelter on the composition of the sward.

One of the most intractable problems is to make sure that the shelter provided does in practice achieve its purpose. How easy it is to say that this purpose is to modify the micro-climate or to avoid under certain adverse weather conditions environmental stress in sheep and cattle. We need to know more of the effect of wind and rain on hill-going animals and this includes the determination of their ability to combat bad weather conditions by their body metabolism and their fleeces. Dr. Blaxter, formerly of the Hannah Dairy Research Institute and now Director of the Rowett Research Institute, and his colleagues have achieved a sustained output of original work of value to all concerned with animal health. The relevance of this to shelter research is direct in that it helps to establish the threshold over which animals are affected by stress conditions.

Bottom belt across contours from 400 to 850 ft at the College Farm, Aber

Climatic conditions

A rainfall of 50–55 inches annually, with rain on an average of 270 days a year, average wind speed of 16 m.p.h. and relative humidity of 83 per cent present only some of the most difficult practical obstacles to establishing shelter. The dramatic effect of overcoming these are to be seen at the Republic of Ireland's Peatland Research Station, Glenamoy, Co. Mayo. There on an unstable, acid blanket bog, on a windy, wet and exposed site, the Director, Mr. P. J. O'Hare has succeeded in raising remarkably effective shelter-belts of *Pinus contorta*, Sitka spruce, larch, and even New Zealand flax (*Phormium tenax*), as well as birch and alder to protect experimental grassland plots grown on virgin peat. Where the growing medium contains 89–93 per cent water and 7–11 per cent dry matter (1·2 – 2·4 per cent ash), is very deficient in potassium, with practically no phosphates and deficient in calcium, to say nothing of a critical lack of trace elements, the argument often heard among those concerned with shelter research as to the economics of fertilizer application sounds mildly irrelevant!

One feature of any research work into some of the problems of shelter is the importance of meteorological observations and data, including measurement of wind, rain and temperature often at high altitudes or on exposed sites. To leave scientific instruments in these situations for any length of time brings its own problems. Instruments must be robust, efficient and, if possible, secured against interference or even petty theft by vandals. Since the early days of improvisation considerable advances in automatic recording have been made. Dr. Gloyne, of the Meteorological Office, has closely followed the development of instruments and has done a great deal of work in interpreting meteorological data obtained by those directing shelter research experiments. At the University of Reading some thought has been given recently to the possibility of recording on magnetic tape, using an ordinary domestic tape recorder, the various elements of micro-climate, e.g., temperature, wind speed, humidity, etc. This tape could, by means of a suitable interface, be used with a computer for rapid printing out of data, a considerably speedier method of obtaining micro-climatological observations by means less susceptible to damage than the familiar meteorological 'ironmongery'.

Organization of research

Shelter problems are seldom the first concern of those whose research may nonetheless throw light on them. Animal physiologists, meteorologists, plant physiologists, botanists and foresters represent some of the disciplines concerned. There was clearly a need to bring together all those who had something to contribute. The Ministry of Agriculture, Fisheries and Food decided in 1962, when the Agricultural Improvement Council for England and Wales was disbanded, to continue in being the Shelter Research Committee originally set up by the Council. In 1965 it was made a Joint Committee with Scotland and a representative of Northern Ireland was added. The terms of reference are to keep the Ministry and the Department of Agriculture and Fisheries for Scotland informed of developments and trends in the field of shelter research and to advise on those research projects initiated and financed by the Departments. The committee has sponsored research at various centres and has acted as focal point for information

about shelter research. Notably, it has organized two symposia in Aberystwyth and Edinburgh where those concerned with various aspects of shelter research have met and reviewed work in their special fields which might be relevant to the common topic of shelter. The symposia papers give a broad picture of the progress of research work at the centres mentioned in this article. The committee has helped in other ways to see that more effort is put into the examination of shelter problems by acting as a forum where those intending to begin research on problems relating in some way to shelter, may discuss their projects in detail, obtain helpful criticism and suggestions and, if need be, assistance in obtaining funds.

Communicating results

Although the input of funds for shelter research has so far been relatively small it is only right to consider if the industry is getting value for money. Is the work truly relevant to agriculture? The need for shelter and the problems of providing it effectively and cheaply are very much the concern of landowners and farmers. Is research likely to produce practical results capable of use on the farm? So far, those concerned with advice to farmers and landowners on shelter problems have usefully augmented their knowledge and experience from the early results of research and the Ministry's F.E.F. Leaflet, *Shelter belts for Farmland*, is regularly revised to take account of any new knowledge. Are the results of research available reasonably quickly? This is a fair question; the difficulty here is that the inherently slow growth of natural shelter imposes severe limits on the speed of this type of research. However, these limitations do not apply to nearly the same extent in the horticultural field, where horticultural advisers have been able to pass on quickly to growers the beneficial results of research into the provision of low shelter whether natural or artificial.

Another test to ensure that shelter research is on a sound basis is to inquire if an adequate number of suitably skilled men are available to do it. This is a problem in any field of research and does not apply peculiarly to shelter. So far there has been a sufficient supply of post-graduates to work under the direction of Heads of University Departments; because it is a fringe subject drawing on primary disciplines of other Departments the personal quality of the individual research workers must be assessed, not only by their own skill but also by their readiness to consult with others who may have something to contribute.

Further prospects

What of the future? Animal physiologists tell us we need to know more about climatic thresholds over which animals suffer from stress. Then we need to know how to introduce natural or artificial shelter to achieve practicable changes in the micro-climate of a particular situation. This includes investigating the most effective size, constituents, orientation of shelter, cost and returns of the shelter over its useful life. Shelter research work is slow. We can agree with Horace Walpole that 'the deliberation with which trees grow is extremely inconvenient to my natural impatience' but, like him, we have to put up with it. Shelter from trees or hedges takes its own time to become effective but meanwhile, as work goes on, it is important that useful information from it should be passed on to those contemplating

shelter planting. It should not be forgotten that there is a great wealth of experience from the past and, without knowing all the answers, it is possible to give much useful practical advice. Indeed, members of several University Departments, the Forestry Commission and the Agricultural Land Service, do give advice on the establishment of shelter-belts; there are useful advisory leaflets available and at least one recent comprehensive book on the subject. The planting of shelter is a long-term business and the advisory literature available should be read by those about to invest money in this form of improvement. At the same time, in these competitive days, the economic results of an earlier bite of grass for better doing animals seems an attractive reward for money well spent on a countryside improvement which all can welcome.

This article has been contributed by **R. G. A. Lofthouse, F.R.I.C.S., F.L.A.S.,** the Regional Land Commissioner for the Ministry of Agriculture, Fisheries and Food in the South-Eastern Region, who is Chairman of the Ministry's Joint Shelter Research Committee.

A.L.S. Rent Enquiry

Farm Rents in 1967

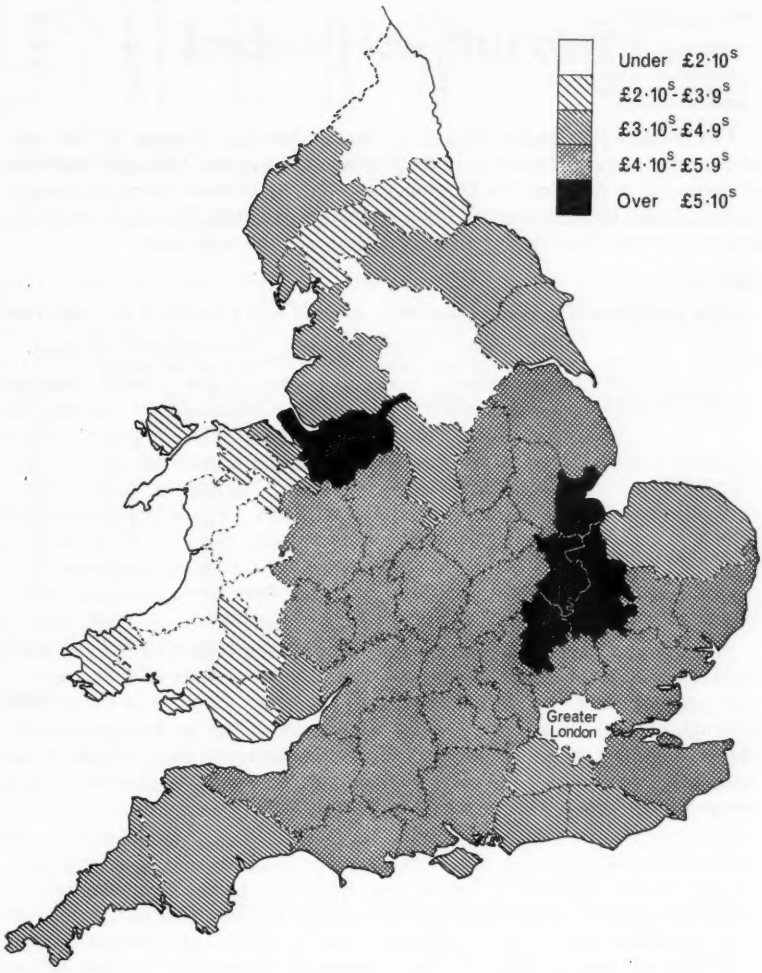
FARM rents in England and Wales rose by about seven per cent in 1967. This is one of the main findings of the Agricultural Land Service's latest enquiry which covered some 3½ million acres or 26 per cent of the total rented farmland. Average rents per acre of crops, grass and rough grazing were as below:

	October, 1966	*October, 1967*
	£ *s.*	£ *s.*
England	4 3	4 9
Wales	2 2	2 5
England and Wales	3 17	4 3

The regional variation in rents is shown by the map on page 181. The main features are the high rents in the Cheshire Plain and the intensively farmed areas of Cambridge, Lincs. (Holland), Huntingdon and Bedford and the broad band of counties with above-average rents in the Midlands, East and South of England. The lower average rents are found, as might be expected, generally in the upland and high-rainfall counties of Wales and the South-West and North of England.

Average county rent levels, 1967

Average rent per acre of crops, grass and rough grazing



Among the farms which had a rent change during 1967 nine out of ten had a previous change earlier in the 1960s. On most of the remaining farms the last rent change had been in the 1950s; on only a very few—about one per cent of the total—was the previous change before 1950.

The new rents fixed vary, to some extent, according to the method used in setting them. These variations are illustrated in table 1 on p. 182.

Table 1

Average rents per acre by type of rent change

Type	% of sample farms	% of total sample acreage	October 1966	October 1967	% increase
			£ s.	£ s.	
New tenancy—by tender	0·2	0·4	3 0	6 0	100
by agreement	2·1	2·2	3 6	5 3	36
Sitting tenant—by agreement	17·4	21·1	4 0	4 18	24
by arbitration	0·3	0·2	3 19	5 15	46
All farms with a rent change	20·0	23·9	3 19	4 19	26
Farms with no change	80·0	76·1	3 16	3 16	—
All farms in sample	100·0	100·0	3 17	4 3	7

The average rent increase on those farms showing a change in rent was 26 per cent, about the same as in the previous three years. The small minority of farms let to new tenants by tender showed, as in most years, the largest proportionate increase and the highest average new rent. Regional variations in the new rents fixed by agreement are shown in the table below.

Table 2

Average rents per acre at mid-October, 1967, on farms with a change of rent since 1966

Ministry region	Rents agreed with new tenants*			Rents agreed with sitting tenants		
	Average size of farm (*acres of crops, grass and rough grazing*)	Average rent	% increase over previous rent	Average size of farm (*acres of crops, grass and rough grazing*)	Average rent	% increase over previous rent
		£ s.	%		£ s.	%
East	258	6 3	39	323	5 13	29
South-East	214	5 7	33	220	5 9	21
East Midland	174	5 9	42	232	5 3	24
West Midland	158	5 19	24	141	5 15	17
South-West	171	5 8	32	216	4 15	23
North	180	4 16	41	208	4 3	23
Yorkshire/Lancashire	134	4 13	42	142	4 8	22
England	177	5 8	35	206	5 1	23
Wales	141	3 8	44	114	3 3	26
England and Wales	171	5 3	36	194	4 18	24

*Excludes new rents by tender

The average new rent fixed in 1967 was in the region of £5 per acre. Between individual farms there is, of course, a wide range of differences in rent per acre. Just over 10 per cent of all new rents reported in the enquiry in England and Wales were of £7 10*s.* or more per acre and a similar proportion were under £3 per acre. In Wales, however, over a third of the new rents were under £3 an acre while at the other extreme a fifth of those in the West Midlands were of £7 10*s.* or more.

The Rural Industries Bureau

Shirley Pickett, *Information Officer, R.I.B.*

WHAT does the term 'rural industries' conjure up in the imagination? Thatching? wrought iron? pottery? While this might have been a fairly accurate picture of the British rural industrial scene of pre-war years it is far from true today. Things have changed considerably, and the Rural Industries Bureau, a government financed advisory organization, set up to help country businesses in England and Wales, spends a relatively small part of its time on what are normally termed 'craft' industries.

Most of the technical and business advisory services, administered through County Rural Industries Committees, are concerned with firms, which though small and remote, are using techniques and machines as sophisticated as those of their larger urban counterparts. This does not mean that the crafts are dying, but since the Bureau was set up in 1921 there has been a shift of emphasis away from thatching, saddlery, basketmaking and pottery to such work as moulding glass fibre and plastics and manufacturing electronic or mechanical components.

Policy

The policy of the Rural Industries Bureau (and of its associates, the County Rural Industries Committees of Rural Community Councils) is to provide, within the limits of manpower and money available through grants from the Development Fund, facilities to assist the development of rural industries in England and Wales. The intention is to encourage in rural areas useful and prosperous industries which serve the needs of the countryside and the nation. Existing industries are helped to develop where this is practicable, and technical and business management advice is made available to those considering setting up new industries. The policy recognizes the interdependence which exists between town and country, and the need for a diversity of small industries in country districts providing an adequate volume of employment, in addition to the basic industries of agriculture, horticulture, fishing and forestry.

Firms contributing directly or indirectly to the production of goods for export rank with the agricultural ancillary trades and those offering prospects of increased employment for priority of advisory services. Whilst the services of the Rural Industries Bureau are aimed at fulfilling present-day needs by adapting the skill of country workers to meet them, it must also look to the future by guiding skills and ideas into channels which offer prospects of development.

Bureau advisory services

Today a thatcher is just as likely to inquire about job estimation as about supplies of straw or reed, and the Bureau advisory services include the following:

advice on workshop layout and new buildings including preparation of preliminary drawings;

advice on the choice of machinery and workshop equipment and instruction in machinery maintenance;

individual and group instruction in techniques including welding, lathe turning, agricultural machinery, electronics and hydraulics, wrought ironwork and farriery;

specialized advice in the clay industries including the use of the facilities of a modern clay testing station;

Advisory accountancy, costing and estimating, business management; marketing and market surveys, participation in exhibitions and trade fairs, both at home and overseas with specialist advice on exporting.

A work study team is also available to advise on method study and work measurement.

Experimental workshops

The Bureau runs a trouble shooting service to solve specific problems. Often its technical staff will build a prototype machine to test their theories. The experimental workshops may house such diverse machinery as a straw press for making archery targets and a self-propelled air distributor for brickyard drying sheds. While nylon coffee pot handles are being made in one corner a scale model of a boatyard is under scrutiny in another.

Agricultural machinery courses

Working in close co-operation with the principal manufacturers of agricultural machinery, the Bureau provides a unique countrywide service of instructional courses in agricultural machinery repair and maintenance. Last year thirty courses were given and at each course students received an intensive three days' instruction in tractor hydraulic equipment, tractor electrical equipment, diesel engine maintenance, combine harvester and pick-up baler repairs and adjustments. Publicity given to training in general since the Industrial Training Act was passed in 1964 has made the management in small firms increasingly aware that not only are highly trained men essential to give a service which becomes more complex each year, but that their firm cannot stay competitive without them.

R.O.P.E.

Before 1962 it was clear that there existed in rural areas of England and Wales a reserve of engineering capacity that was mostly under-employed and, because the principals of rural firms were tied to their shop floors, and located in remote areas, they possessed few, if any, contacts with major industry from which a constant supply of orders could be derived. At the same time large-scale industry was experiencing its own problems of productivity. Clearly, it was important to resolve this situation by bringing small and large-scale industry together with a view to a mutual solution of their problems. To this end a 'work placement' scheme was initiated by the Bureau. Now called R.O.P.E., an abbreviation for 'Register of Production Engineers', it is basically a classified index of rural engineering firms, all expert in their specialist technical fields, drawn from the Bureau's records.

Students attending intensive three-day Bureau course in agricultural machinery repair and maintenance receive instruction from Bureau Technical Officers

R.O.P.E. has amongst its aims:

1. The provision of more jobs in rural areas by expansion and development, thus helping to stay depopulation of the countryside.
2. To make large-scale industry aware of the potential of skilled engineering capacity available in rural areas at relatively moderate cost.
3. To encourage a habit of co-operation between large and small scale industry.
4. To foster the growth of parallel technical and administrative development of rural based industry through its contact with large industry.

Apprenticeship schemes

Apprenticeship schemes are in operation in thatching, saddlery and the utilization of minor forest produce. Full information on local opportunities for apprentices can be obtained from county Rural Industries Organizers. The Organizers can not only advise on prospects but, as they are constantly in touch with the workshops in their area, they can also assist with the selection of suitable employers.

Eligibility for aid

To qualify for Bureau services, rural industries must be located either in the countryside, villages, or country towns, with a population of up to approximately 10,000. Rural industries assisted by the Bureau fall into two main groups: manufacturing and servicing industries. The first category includes industries producing goods such as engineering products, bricks, tiles, woodwork, ironwork and plastics. Into the second category fall those industries which provide a repair and maintenance service, such as that given in the workshop of an agricultural engineer, farrier, or in a repairing garage. The producing industries may or may not use local raw materials, and may well sell outside their locality as well as within it. The second group mainly serve their locality. Those businesses wholly concerned with retailing are at present excluded. Bureau services are usually restricted to smaller rural industries providing employment for not more than twenty skilled operatives together with ancillary staff.

Vining and Dried Peas

The Director of the Pea Growing Research Organisation, A. J. Gane, considers the problem of the final plant population and its profitability, with particular reference to plant establishment and survival

THE results of the extensive research conducted by the Pea Growing Research Organisation on the subject of pea plant population and the influence which it exerts upon yield and profitability were described by J. M. King in the April, 1967, issue of *Agriculture*. The importance of obtaining the optimum plant population was clearly demonstrated, and practical measures to assist in doing so were outlined.

In pursuing the subject still further, it is soon appreciated that a number of factors may combine to affect germination and establishment and that since they will then affect also the final plant population and its profitability, they must be recognized and taken into account whenever possible. In considering the problem from this point of view, therefore, the aims are:

1. to ensure that the greatest possible proportion of seeds sown produce plants which survive to maturation and,
2. to make an appropriate allowance for those which will not do so.

Seed health and vigour

While it is universally accepted that the use of 'good seed' is one of the prime essentials in successful crop production, the standards by which pea seed should be judged are perhaps less well known, as are some of the pitfalls which await the unwary. A high percentage germination is an obvious necessity, but this may well present only part of the key to field performance.

Laboratory germination tests are carried out in sand or compost, in conditions which are carefully standardized and which give the seeds every chance of germinating and emerging in 7–10 days. It has long been recognized, however, that such a test cannot be expected always to reflect accurately what will take place throughout a range of field conditions.

'Hollow heart'

One of the factors which is known to influence the vigour and field survival of pea seed is the disorder known as hollow heart, which is typified by the presence of hollowed and sometimes deeply cracked areas in the centre of the adaxial surfaces of the cotyledons. Until recently it was impossible to predict which seeds within a sample were likely to be affected by hollow heart; no direct comparison could be made between affected and unaffected

seeds of one sample. This difficulty was overcome through research by the P.G.R.O. (details as yet unpublished) thus enabling direct comparisons to be made in 1966 and 1967; it was found that there were differences in survival of 20 per cent and 70 per cent in the two years respectively between affected and unaffected seed of the same sample, when sown early in the year.

Marsh spot

Seeds affected by marsh spot are likely to produce weak and malformed seedlings, the primary shoots of which often die before emergence. It is true that they are frequently replaced, but this takes time and in adverse conditions results in an unduly prolonged period before establishment is achieved. This disorder is of course to be expected in seed saved from crops deficient in manganese, a trace element which is often deficient or unavailable on marshland soils and on others where the pH is high. There is a particular type of yellowing associated with pea plants deficient in manganese, a yellowing round the leaf margins and between the veins; growers who notice such symptoms are strongly advised to apply corrective treatments and to have the produce tested for marsh spot before using it as seed.

Leaf and pod spot

Leaf and pod spot is the general term applied to describe diseases caused by a related group of three fungi, *Ascochyta pisi* being probably the most common. The disease is seedborne, and although stained seeds are frequently found to be infected, the absence of staining is certainly no guarantee of good health. The disease develops rapidly once infected seeds imbibe moisture and begin to germinate; dark lesions appear on the seedling root or shoot, as well as developing within the seed itself, frequently resulting in early death. As the common name of the disease implies, its activities are by no means confined to the early stages of growth, but it is these that we are considering here. There is at present no means employed on a commercial scale for the disinfection of pea seed, so that the reduction of risk by seed testing and the rejection of heavily infected samples, coupled with the use of fungicidal seed treatment and adequate rotation, are all the more important.

Soil pests

Plant population may also be effectively reduced by the depredations of leatherjackets, cutworms and sometimes millipedes. Where peas are to be grown after grass, or where quantities of vegetable matter have been incorporated in the soil during preparatory cultivations, examination is strongly advised before the seedbed is worked down and drilling commenced. Soil pests may be effectively controlled, but the incorporation of a pesticide is often an important factor and this is precluded once the seed is sown.

General conditions

Adverse conditions, whether due to soil type, low temperature, high soil moisture or combinations of these and other factors, slow down the rate of establishment of pea seedlings; slowly developing seeds are continually at risk from *Pythium* spp and other soilborne pathogens, thus bringing about a reduction in final plant population.

The practice of early drilling is so vital to efficient pea production that awaiting the ideal seedbed is out of the question. The answer therefore lies in the recognition of adverse conditions and the making of appropriate allowances to overcome their influence.

The P.G.R.O. has produced much evidence to show the value of achieving the optimum plant population in vining peas; the grower will be amply repaid for the little trouble and expense involved in ensuring its achievement in practice.

Further reading

For more information and practical guidance on this important aspect of pea growing, reference should be made to P.G.R.O. Miscellaneous Publication No. 18, *Row widths and plant populations in vining peas*, copies of which are available on request from the Research Station, Gt. North Road, Thornhaugh, Peterborough.

This article has been contributed by **A. J. Gane, C.D.A., F.R.M.S., F.R.S.A.,** who is Director of Research at the Pea Growing Research Organisation's Station at Thornhaugh, Peterborough.

The Ministry's Publications

Since the list published in the March, 1968, issue of *Agriculture* (p. 113) the following publications have been issued:

MAJOR PUBLICATION

Dehydrated Vegetables for the Caterer (Revised) 2*s.* 3*d.* (by post 2*s.* 6*d.*)

FREE ISSUES

ADVISORY LEAFLETS

No. 13. Apple Sawfly (Revised)
No. 28. Apple Blossom Weevil (Revised)
No. 53. Tomato Verticillium Wilt (Revised)
No. 54. Black Bean Aphid (Revised)
No. 350. Winter Cabbage and Savoy (Revised)
No. 376. Weed Control in Peas (Revised)
No. 493. Methods of Feeding Silage (Revised)

The priced publication is obtainable from Government Bookshops (addresses on p. 198) or through any bookseller. Unpriced items are obtainable only from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex.

10. Cumberland (Whitehaven District)

J. M. Wilson

WHITEHAVEN, on the far west tip of Cumberland's coastline, is an hour's drive south-west from Carlisle and to the furthest corner of the district on the Lancashire border at Millom is another 35 miles. This is perhaps the quickest way to appreciate the size of Cumberland and the geographical position of Whitehaven district, tucked away between the Lake District and the West Cumberland coast.

The coastal plain area is relatively narrow but is favoured with some excellent soils and a very kind climate. In particular, in the area stretching south from Whitehaven to Seascale, where the soils are mainly derived from new red sandstone, there are some of the most desirable farms in this country. It is no doubt significant that the present West Cumberland Farmers Ltd. owes its origin to a handful of pioneer co-operators in this little Eden on the West Cumberland coastline, where conditions are ideal for grass growth and milk production; where Mr. Edwin Bushby has succeeded as a pioneer of intensive grassland farming on his 125-acre Watson Hill Farm; where between October, 1966, and February, 1967, a field of August-sown Italian ryegrass produced a crop of 3 tons of grass (8 cwt D.M.) per acre. On some of the soils in this area, early potatoes, Home Guard the exclusive choice, can be an important item in the farm budget.

To the south of Seascale and the Calder Hall Atomic Reactor Station, the soils change to heavy silty clays and to an area of small-scale dairy farming, but still with a climatic advantage enabling the Muncaster Gardens near Ravenglass to sport a few outdoor 'palm' trees and an abundance of bamboo growing wild. Rhododendron and azalea on a grand scale are an unforgettable feature of Muncaster Gardens at Whitsuntide.

Inland from the coastal plain the transition to upland and mountain is rapid with, in the north of the district, an intermediate stage covering the old mining districts of Cleator and Frizington. Here the rearing and dairy farms stand out in bleak contrast and the problems of grassland management stretch the ingenuity of farmer and adviser alike. Indeed the Cumberland and Westmorland Grassland Society has formed a study group to investigate the problems of the management of heavily stocked wet land, where the under-drainage is considered to be adequate.

In this area, the soft rush is a dominant feature in grassland, and the soil derived from the coal measures series is a difficult poorly structured silty

clay. Recently reseeded opencast sites show a lamentable tendency to return to rushy and mossy grassland. The suckler cows in this area are mainly Galloways which are crossed with the Hereford, but one or two Charolais × bulls are being tried on an experimental basis. Again as stocking density increases the outwintering of the suckler herd can become a problem leading to the adoption of cubicle housing and self feeding. Breaking with tradition in this area is Mr. J. A. Hartley on 300 acre Acrewalls, near the mining village of Frizington, where the suckler herd will be in cubicles next winter and where all the 50 or so suckler calves produced are finished on manger fed silage plus bought-in barley. Draft Swaledales and Herdwicks kept to give one or two lamb crops are a popular enterprise on many of these farms; these may be bought for as little as 40*s*. to be sold fat after two years for perhaps more than the original buying bill. This enterprise shows a remarkably high return on capital but with a high mortality risk. Mr. Hartley is using a Finn × Border Leicester tup on a number of ewes this winter in comparison with the Blue-faced Leicester. The present very good return on capital from these ewes may even be improved.

The inland areas of Whitehaven district cover an expanse of open fell between Ennerdale in the North and the remote community of Ulpha on the Lancashire border. Sca Fell dominates the scene at the head of the Eskdale and Wasdale valleys. These valleys and the surrounding fells are the home of the Herdwick. Most of the holdings are owned by the National Trust and tenancy agreements cover the 'renting' of the sheep stock that goes with the farm and can stipulate the number and ages of Herdwicks which must be given up if the tenancy is relinquished. This is the open fell country that brings the tourist and the fell walker and many of these West Cumberland upland farms have achieved a happy blend of tourist and farming income.

While many of the Herdwicks which roam the high fells are small poor sheep, the best of the breed, as seen at the Eskdale Show, are excellent sheep for these conditions. However, because of the poor lamb crop (around 70 per cent) and high replacement rate, the present management systems do not allow for selection of female breeding stock. All ewe lambs are retained for breeding with the inevitable result that quality suffers. There is great scope here for a co-operative enterprise to make the best tups available to more of the smaller flock owners. The level of management for away-wintered or home-wintered hoggs is improving. More needs to be done towards the wider adoption of improved management techniques to effectively break the downward spiral of low percentage lambing, no selection, poor ewes and low lamb crops. The aged wether is a factor in this situation. Wether lambs may be retained on the fell for 3 or 4 wool clips before being sold fat. While these wethers have a most useful role in stocking the more inaccessible grazings, and in other ways, a better balance between their numbers and the breeding ewe numbers would seem desirable on many fells where the wethers are in competition with the breeding ewe and as such are contributing to low output per ewe.

The district's western boundary is reached via the hair-raising twists and slopes of Hardknott Pass leaving behind a district with unsurpassed scenic beauty and ranging in conditions from some of the best lowland farming to some of the poorest, hardest (and wettest!) hill country in the British Isles.

Good management is the key factor in cutting costs for sheep farmers

Lamb Wintering Sheds

L. J. Williams, *Agricultural Land Service, Aberystwyth*

It is not surprising that with economic pressures and smaller profit margins, the A.L.S. officer finds a great deal of interest amongst farmers in anything which is likely to be more profitable. This is particularly the case with some upland farmers who, despite the renowned excellence of their flockmasters, find difficulty, due to their experience of the rigours of winter, in rearing lambs successfully on the hillside. For generations, therefore, it has been their practice to transfer the lambs to a more favourably situated lowland area from about mid-November to the end of the following April.

With the reluctance of lowland farmers to lose the early bite of grass to sheep, the upland farmer is faced with increasing difficulties of finding anyone to 'tack' the lambs during these winter months. Even if he is successful in doing so there is the problem of ever-increasing 'tacking' charges and transportation costs.

Apart from these difficulties, present-day economic pressures and smaller profit margins render it increasingly important to make the flocks more profitable and competitive with other farming enterprises and this is where good management becomes a key factor, particularly in systems involving high stocking rates throughout the year. Moreover, if summer pastures are to provide maximum productivity during the next season, it is essential that they should be rested during the winter.

The lamb wintering shed may well provide the answer to these problems. Elaborate or expensive new buildings are not required. A simple cheap building, sited to take advantage of existing natural shelter, with easy access to a roadway, water supply and, if possible, electricity, is suitable. Such a shed may be used to house the lambs overnight only; from mid-morning to mid-afternoon they may be allowed to run out to get what foggage is available to supplement indoor feeding.

The shed must be so constructed as to prevent the air inside becoming so warm that the change in temperature on leaving the shed would affect the health of the lambs. The ideal shed would have an inside temperature equal to that outside. Ample ventilation is, therefore, imperative. A prefabricated frame in steel, concrete or timber is probably best but one of pole and corrugated sheet construction can be satisfactory and has the advantage of cheapness.

A roof of asbestos or metal sheeting or, alternatively, timber and felt, is suitable. For the walls, plywood or oil-tempered hardboard to a height of 3–4 ft with open boarding above—that is, 4-in. vertical boarding with 1-in. space between—for the upper part of the walls, is desirable. The floor is all-important, as the success of the system can depend on its design and construction. Sheep are prone to disease of the feet but if the feet are kept clean, infection can be substantially reduced. The floor should, therefore, be of a type of construction which allows the dung to fall through a collecting pit below. This is done by forming the floor of slats $1\frac{1}{2}$ in. wide, $1\frac{1}{4}$ in. deep, with a $\frac{5}{8}$-in. space between. The slats are supported by 4 in. $\times$ 2 in. joists, which again should be splayed to prevent holding dung on top and the required depth below the slatted floor is about 1 ft 6 in. Cleaning out the dung need only be carried out once a year and the whole floor should be constructed in sections 8 ft long $\times$ 4 ft wide, thus allowing each section to be easily lifted by two men. It is important that the slats should be laid parallel to the entrance door. If they are laid at right angles the lambs, seeing the voids between the slats, will be reluctant to enter the shed. Experience has shown that for the smaller breeds the space allowance should be 5–6 sq. ft per head rising to about 7 sq. ft for larger breeds.

Feeding arrangements must be carefully considered. It is now becoming the practice to feed both hay and concentrates from box-type troughs which can be easily and cheaply constructed by unskilled labour. A further advantage of this type of trough is that it can be used to divide the flock into convenient batches for feeding and handling. An allowance of 7–9 in. of trough space per lamb should be made.

The provision of drinking water is all important. Sheep will refuse to drink water which has become warm or even slightly fouled. The best way of providing water is to set a trough up on a concrete slab so that the lambs have to step up to drink. If the level of water can be maintained from a slow-running tap with excess water running away through an overflow pipe this is ideal. If this cannot be arranged, the water in the trough should be changed at fairly frequent intervals and not less than once a day.

To sum up, a lamb wintering shed can provide more economical accommodation for the flock during the winter months. It can simplify shepherding and above all can rest pastures during the winter months, so that grass is available earlier in the spring when it is most needed by the lambing flock and enable stocking rates on summer pastures to be intensified. Capital investment in the simple type of suitable building need not be heavy, as it may well be possible to spread this over other enterprises since many other uses will no doubt be found for the shed when it is not required for the flock—shearing, finishing fat lambs for market, and turkey rearing in the summer months for the Christmas deep-freeze trade, are some uses that immediately come to mind.

in brief

- **Wiltshire high nitrogen trial**
- **Weaner marketing in Wales**
- **That lambs may safely graze**

Wiltshire high nitrogen trial

In the past two years higher nitrogen usage on the Lackham School of Agriculture's Notton Farm, at Lacock, Wilts., has increased the stocking rate of its dairy herd from one cow on 1·71 acres to one on 1·14 and so released 16 acres which have been put down to barley. During the year October 1964—September 1965, the College herd of about 50 Shorthorns was running on 74 acres to which 64 units of nitrogen were applied. Today, by the application of 300 units of nitrogen the needed grazing area has been reduced to 58 acres.

The first improvement was noticed in 1965–66, when nitrogen was stepped up from 64 to 200 units at a cost of £8·25 per acre; when 300 units were given the following year, the fertilizer cost worked out at £9·88 per acre. It may be asked why these costs in 1966–67 did not rise more markedly. 'The explanation,' says says Mr. L. J. Woodruff, the local N.A.A.S. District Adviser, 'is that in the first year when 200 units of nitrogen were used, there was a greater proportion of complete fertilizer. In fact, the pastures received 65 units of P and K, whereas in the second year they received only 45 units of P and K.'

Average milk yields per cow have risen from 736 to 809 gallons, and milk sales per cow from £116 to £130, increasing the margin over concentrates and fertilizers by £38 per acre.

Starting in March, the more recent applications of nitrogen, at 70 units per acre, were made at weekly intervals after a third of each field had been grazed.

The Lackham trial has been one of four laid down in Wiltshire to increase the use of nitrogen on dairy farms and so raise stocking density and increase profitability. All have done well, which is a pointer to the potential that exists on many similar dairy farms in this and other areas of the country.

Mr. W. J. Brimacombe, the Wiltshire County Agricultural Adviser, holds the view that without having to inject capital the small farmer with 40 or so cows on an acreage comparable with that of Notton Farm, could increase his milk sales by over £1,000 a year and at the same time cash in on a worthwhile crop of barley.

Weaner marketing in Wales

Weaner producer and feeder have been brought together to their mutual advantage by the co-operative marketing enterprise organized by the Welsh Agricultural Organisation Society under grant from AMDEC. It was at a PIDA conference in Aberystwyth in 1961 that a pig feeder pointed to the difficulty of getting a satisfactory supply of weaners, and asked whether a service to bring weaner producers into *direct* contact with feeders could not be organized. At the same conference Mr. H. E. Evans, then N.A.A.S. Director for Wales, spoke of the development of large-scale breeding programmes and the increased use of hybridization as making it more than ever necessary for Welsh farmers to plan their pig production to meet the needs of their market.

The result is seen today, when half a million pigs have been marketed for a return of £3½ million; and between 1964 and 1967, during which time its component groups have increased to nineteen, the monthly throughput of the W.A.O.S. has risen from 1,000 to 12,000 weaners and a marketing network established over Wales that brings every farm no further away than 15 miles from a collecting centre.

The advantages to the feeder of being able to buy good, healthy stock of known origin at a uniform weight and in large numbers at a single collecting centre are as great as those to the weaner producer, who has a regular market at guaranteed prices. Emphasis on a high quality and consistent product, which was one of the main reasons for forming the Federation of Welsh weaner groups, has steadily increased and justified in no uncertain economic terms the appointment of their marketing officer, Mr. Alun Thomas.

The Federation has also endeavoured to improve the quality of stock by encouraging groups to make rigorous selection at the time of sale and by attempting to provide the weaner producer with information on the grading of the finished pigs. Planned stock improvement is also envisaged and a pilot scheme for gilt testing facilities has been started.

That the scheme has had such unqualified success is due to the wholehearted support and loyalty of its members. This is the key to the healthy growth of any co-operative venture: many have failed when this cardinal point has been lost sight of.

The W.A.O.S. report pays tribute to the leaders of individual groups, whose enthusiasm and experience have been reflected in the activity of the general body of producers. The chain of co-operation can be no stronger than that of the links which compose it. The report puts the point succinctly: 'Though co-operation is a movement of the many, it is driven forward by the enthusiasm of the few. Co-operation no doubt breeds co-operators, but it does not begin to exist until there are co-operators, and weaner marketing in Wales has been fortunate in having co-operators to promote it. Its future will depend on whether it breeds co-operators to succeed the promoters.'

That lambs may safely graze

WHEREVER possible new leys should be assigned to young lambs for the first 6–8 weeks of their grazing life; that is, pasture that did not carry sheep the previous year. This is a fundamental precaution against nematodirus disease, which can reduce lamb crops by 10–20 per cent—and even more disastrously in a bad outbreak.

On other than clean pasture infective larvae of the worms responsible, which were voided as eggs in the dung during last year's sheep stocking, will be ingested by the lambs along with the herbage. This re-starts the cycle whereby the larvae pass into the small intestine and burrow their way into the intestinal wall to continue their development. It is at this stage (usually late May—early June) that the disease shows itself without warning, often by heavy scouring and subsequent severe dehydration. The eyes become sunken, the belly 'tucked up' and the wool rough. Death may ensue within as little as two days.

Hatching of the worm eggs comes with the warmth of the spring sun, so that the peak of larval infection varies with the weather. Cold conditions resulting in a late spring delay hatching, thus ensuring that the trouble lying latent in the pasture coincides with lamb grazing.

In this connection the forecast of the likely incidence of nematodiriasis which the Ministry issues in mid-April is particularly important to those farmers who have no clean ley available. Modern worm remedies are useful in preventing infestations severe enough to cause disease. A course of dosing starting in early May is recommended, but owners should seek the advice of their veterinary surgeons.

AGRIC

AGRICULTURAL CHEMICALS APPROVAL SCHEME

The booklet 'Approved Products for Farmers and Growers, 1968'

is now available

Copies may be obtained, free, by farmers and growers from the Ministry Divisional Office appropriate to their area.

Since the above booklet went to press, the following products have been approved:

INSECTICIDES

CHLORFENVINPHOS
Liquid Formulations
Sapecron Liquid—Ciba

FUNGICIDES

DODINE
Wettable Powder Formulations
Melprex—May and Baker
Liquid Formulations
Melprex 20—Cyanamid

MERCURY
Liquid Formulations
Bugges Liquid Mercury D.G.4—Bugges

HERBICIDES

BROMOXYNIL with MCPA
A translocated and contact herbicide for the post emergence control of a wide range of annual weeds, including knotgrass, redshank, black bindweed and scentless mayweed on spring-sown wheat, barley and oats.
Liquid Formulations
Buctril M—May and Baker

CHLORTHIAMID
A soil acting residual herbicide for the control of total vegetation and the selective control of annual and some perennial weeds in blackcurrants, raspberries in Scotland and in forestry.
Pelletized Formulations
Prefix—Shellstar

DICHLORPROP
Potassium Salt Formulation
Dichlorprop M and B—May and Baker

DINOSEB
Amine Salt Formulations
DNBP 30 Amine—Campbell

DINOSEB ACETATE
A contact herbicide for use post-emergence on cereals, peas, beans and leguminous forage crops.
Wettable Powder Formulations
Ivosit—Hoechst

DINOSEB ACETATE plus MONOLINURON
A contact and residual herbicide for the pre-emergence control of weeds in dwarf beans and potatoes.
Wettable Powder Formulations
Ivorin—Hoechst

METHOPROTRYNE plus SIMAZINE
A post-emergence herbicide for the control of blackgrass and certain broad-leaved weeds in winter wheat.
Wettable Powder Formulations
Gesaran—Fisons

METOBROMURON
A pre-emergence residual herbicide for the control of annual weeds in potatoes.
Wettable Powder Formulations
Patoran—Ciba

TRIFLURALIN
A soil-incorporated residual herbicide for the pre-emergence control of weeds in transplanted brassicas.
Liquid Formulations
Treflan—Elanco

MISCELLANEOUS

METALDEHYDE
Dry slug baits
Sluggex—Brookes

Third List of Additions to Supplement No. 1 of 'Chemicals for the Gardener'

Adco Slugtox Powder—Adco
Based on metaldehyde

Adco Slugtox Spray—Adco
Based on metaldehyde

New Liquid Doff Insecticide—Doff-Portland
Based on DDT plus BHC

Rentokil Wormkiller for Lawns—Rentokil
Based on carbaryl

Cuthbert's Greenfly and Blackfly Killer—Cuthbert
Based on malathion plus DDT

Books

Irish Agricultural Production—Its Volume and Structure. RAYMOND D. CROTTY. Cork University Press. 42*s*.

The author of this book believes that official Irish agricultural policies 'have been ill-conceived and militated against rather than furthered the interests of the Irish people as a whole and the interests of the majority of the Irish farming population'. This is a challenging conclusion, the more so for being the outcome of a massive analysis by an economist whose motive derived from his own farming in Co. Kilkenny.

The system of land tenure in operation at different times is shown to be a key factor in determining the prosperity of agriculture and the Irish economy as a whole. Under the owner-occupier system which now prevails there has been a marked tendency towards immobility, in contrast to the former highly competitive bidding for tenancy. This, in the author's view, has brought about the serious misallocation of land and is one of the central themes of the book.

The author combines a possible solution to this intractable problem with his remedy for the inefficiencies, as he considers them, of the present system of agricultural subsidies and grants. His proposal is to replace the taxation necessary for the financing of these subventions by a land tax. He would also abolish protection and the subsidising of exports.

His case against the subsidies and grants is that the taxation needed to pay for them is derived largely from farmers themselves, and has also the effect, he maintains, of increasing the cost of their other inputs. Protection also has the effect of raising input costs. On balance he concludes that farmers receive less in the form of grants than they lose in higher costs of inputs. Moreover, he believes that resources tend to be used uneconomically when grant-aided and to bring a lower return than they would if farmers paid for them in full and themselves decided how to use them to optimum advantage.

Under a land tax of around £4 an acre only farmers of a relatively high level of efficiency, at least equal to the average of 'conacre' farmers (those who take on extra land on short leases), would be able to earn adequate incomes. Inefficient or aged farmers would not be able to maintain even their present relatively low levels of income and would do better to sell their land (though they would be able to retain their houses) and invest the proceeds.

Mr. Crotty's proposals are clearly subject to a number of difficulties and doubts. The rental value of owner-occupiers' improvements to the land would no longer bring them reward, but would accrue to the State. In consequence landowners might consider that they had a right to compensation for the expropriation of rent, while investment in an asset the (economic) productivity of which, shorn of rent, would be nil, might seem unattractive. The author acknowledges that opposition would exist though more might have been said on possibilities for minimizing it.

The overall value of this exceptionally well-documented and cogently presented work may lie less in the actual remedies proposed, which may not all gain general acceptance, than in examining from many different angles the weaknesses of the past and present structure of Irish farming, and in presenting an undoubtedly sound economic objective. This in turn may well stimulate further quest for practicable schemes capable of bringing commensurate benefits. It is a work which for some time to come is likely to repay study by those concerned with Ireland's economic welfare.

P.M.R.

A Bibliography of Farm Buildings Research. Supplement for 1966. Agricultural Research Council, 1968. 20*s*.

The compilers deserve congratulation for having this latest supplement published so quickly. Often work of this nature appears so late as to lose much of its value.

This edition contains 669 references and is in its well-established form. Like its immediate predecessor it ranges over all aspects of farm buildings. It includes references to fire precautions, farm accidents in and around buildings and even such an unusual matter as solar collectors for

collecting heat for conditioning air in animal shelters, or for drying materials. The bulk of it naturally deals with the more commonplace but, nevertheless, essential matters.

The growing importance of labour utilization in and around buildings seems to be recognized judging by the increasing amount of research work in that direction. It seems that at long last the value of work study in agriculture is being realized.

To comment in detail would be an impossible task, but with the forecast increase in dairy herd size just three references will serve to warn against rushing in without adequate thought. All are from the U.S.A. —the home of 'bigness'. One survey showed investment in buildings was 36 per cent of total investment up to 39 cows, 34 per cent from 40–79 cows, and 33 per cent for 80 or more. No dramatic saving there.

Another indicated that the costs of completely mechanized feeding systems were seldom lower than those of manual systems and horizontal silos were more economic than tower silos. The third reported that although cubicles required 75 per cent less bedding than loose housing they needed 25 per cent more labour.

Browsing through the book and reflecting on past issues, one gets a suspicion that research workers are duplicating work already done and coming up with the same results. Can it be they are not paying sufficient attention to this splendid Bibliography?

C.R.

Agriculture in Denmark. Edited by P. H. KNUDSEN. Hutchinson Publishing Group, 1967. 50*s*.

This review of Danish agriculture in the late 1960s is published in five European languages, a reminder that Danish farming is vitally concerned with export markets. The familiar Danish food centres and the intensive advertising of Danish foods, not only in Britain but in other countries, spring directly from the fact that the level of agricultural production in Denmark is three times that required by the home market.

Soil and climatic conditions in Denmark are fairly favourable to agriculture but low temperatures increase the cost of housing animals, the harvest month, August, is the wettest month of the year, and good quality silage is difficult to make. The levels of agricultural production are, nevertheless, very high by all international standards, due to the hard work of generations of farmers, to unremitting attention to land drainage and reclamation; to the use of fertilizers on a considerable scale; the adoption of modern management techniques and the careful selection of suitable crops and stock with a keen eye to consumer preferences.

Britain provides Denmark's largest export market and with other European Free Trade Area partners buys more than half her food exports. In a section of the book dealing with marketing one notes that the division of Europe into two trading blocs, the E.F.T.A. and the Common Market hit the Danish farmer very badly because the few and limited concessions achieved with E.F.T.A. 'cannot remotely make up for losses resulting from being outside the Common Market'.

The book is in effect a symposium written by ten authors each responsible for a different aspect of the subject. This tends to produce some degree of overlap and repetition though some of the points are worth restating.

There is constant reference, for example, to the strength in Denmark's agriculture of the co-operative principle, to the farmer's own co-operative organizations which handle about sixty per cent of the total turnover of feedingstuffs and about forty per cent of the expenditure on fertilizers. Under these conditions individual farms are regarded as units belonging to an effectively integrated industry with a comprehensive network of organizations that supply the farmer's every requirement, provide professional and technical advice and process his products for market at home and abroad.

The Danes believe in the value of education and they like to think for themselves. About ninety-five per cent own their farms and it is encouraging these days to realize that the vertical integration of farming in Denmark is due to the farmers themselves rather than to the State.

It is also quite clear from this interesting book that Danish agriculture has undergone and is still undergoing, changes which parallel those in British farming, for example, a decline in agricultural manpower, the advent of 'hobby' farmers centred mainly on grain growing, the urban encroachment of the countryside and the swallowing up of the smaller farms by their bigger neighbours in the interests of a more efficient economy. A brief outline of the history and development of Danish agriculture and of possible future trends is included.

A.J.L.L.

books received

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P.151 National Farmers Union. P.156 W. F. Raymond. P.157 British Crop Driers Ltd. P.159 National Institute of Agricultural Engineering. P.161 Imperial Chemical Industries Ltd. P.165 D. S. Soutar. P.171 Stanley Evans. P.185 Rural Industries Bureau.

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OFFICIAL APPOINTMENTS

General agriculturists and agricultural specialists of many kinds are frequently required in the effort to match the large demand from the developing countries. The vacancies advertised below are a selection from the many openings which exist now. While they are being filled, other vacancies are arising.

Salaries within the ranges quoted are assessed on qualifications and experience; and the terms of most appointments include free or subsidised accommodation, education grants, family passages, good leave on full pay, etc. A contributory pension scheme is available in certain circumstances.

Most appointments are limited to nationals of the United Kingdom or the Republic of Ireland who are normally resident in those countries.

BOLIVIA

Head of British Mission for Tropical Agriculture

RC 213/22/01

Duties: To lead team of Agricultural experts in current important programme and to be Adviser to Bolivian Government in Tropical Agriculture.

Qualifications and Terms: A relevant degree and wide experience of agricultural administration in Tropics at least at Deputy Director level. Salary £4,500—£5,000 a year subject to British Income Tax plus a variable non-taxable overseas allowance currently payable at rates from £540—£1,310 a year depending on marital status plus entertainment allowance of £250 a year. Contract 2 tours of 18 months.

Pasture Research Officer (British Tropical Agricultural Mission)

RC 213/22/03

Duties: To continue a programme of research on intensive grasses in crop rotations and to advise and work in collaboration with Bolivian technicians on experiments, extensions, seed multiplications, field surveys, etc., with natural and cultivated pastures.

Qualifications and Terms: An honours degree in botany with post graduate experience of range management in the tropics and of work on intensive grasses. A working knowledge of Spanish is desirable. Salary £2,500—£3,100 a year, depending on qualifications and experience, subject to British Income Tax plus a variable non-taxable overseas allowance currently payable at rates from £540—£1,310 a year depending on marital status. Contract: 2 tours of 18 months.

FALKLAND ISLANDS

Grasslands Officer

RC 213/60/01

Duties: To investigate and experiment on development and improvement of grasslands and possibly to establish a small experimental station.

Qualifications and Terms: A degree in agriculture with experience in hill grazing improvement. Salary £1,500—£2,000 a year. 15% terminal gratuity. Contract: 30–36 months.

cont'd overleaf

OFFICIAL APPOINTMENTS

FIJI

Soil Conservation Officer

RC 213/62/07

Duties: Supervision and maintenance of technical standards in soil conservation work, by liaison with District Agricultural Officers who administer all soil conservation extension, machinery and field staff. Arrange in-service training in soil conservation for field staff. Prepare lectures and examinations for the soil conservation course at the Fiji School of Agriculture. Assist in preparation of soil conservation publicity. Advise on soil conservation matters through the Director of Agriculture or through the Land Conservation Board.

Qualifications and Terms: A degree in Agriculture or Science with experience in practical soil conservation. Experience in tropical agriculture is desirable. Salary £ Fijian 1,092—2,181 a year (£ Sterling 1,045—2,087 a year). An inducement allowance normally tax free in the range of £ Sterling 508—829 a year is also payable direct to an officer's home bank account. Terminal gratuity 25%. Contract: 1 tour of 30–36 months..

Soils Scientist

RC 213/62/09

Duties: To carry out soil surveys on a detailed regional basis to follow on the reconnaissance survey already completed and to be responsible for field soil survey work on proposed development areas.

Qualifications and Terms: A 1st or 2nd class Honours Degree in Geology or Geography and postgraduate experience in soil surveys in tropical areas. Salary £ Fijian 1,092—2,181 a year (£ Sterling 1,045—2,087 a year). An inducement allowance normally tax free in the range of £ Sterling 508—829 a year is also payable direct to an officer's home bank account. Terminal gratuity 25%. Contract: 1 tour of 30–36 months.

SABAH

Agricultural Research Officers (Plant Breeders)

RC 213/150/03

Duties: To deal with the selection and breeding of oil palm and cocoa throughout the State of Sabah.

Qualifications and Terms: An Honours Degree in Natural Science with 2 years postgraduate training. A good general knowledge of the subject is essential. Field experience desirable.

Salary $ 9,000—17,040 a year (£ Sterling 1,226—2,321 a year) plus an inducement allowance at present in the range of £ Sterling 804—1,303 a year. Terminal gratui y approximately 20%. Contract: 2–3 years.

Agronomist

RC 213/150/04

Duties: To manage a cocoa or oil palm research station, to investigate cultivation and fertiliser applications and to implement the departmental research programme.

Qualifications and Terms: A degree in natural science with two years postgraduate training. Salary $9,000—17,040 a year (£ Sterling 1,226—2,321 a year) plus an inducement allowance at present in the range of £ Sterling 804—1,303 year. Terminal gratuity approximately 20%. Contract: 2–3 years.

MALAWI

Senior Agricultural Officer (Irrigation)

RC 213/134/015

Duties: To work as part of an irrigation team.

Qualifications and Terms: A degree in agriculture with at least ten years' experience, preferably under tropical conditions. Salary £2,655 a year plus 15%—25% terminal gratuity. A supplement of £100 is also payable direct to an officer's bank account outside Malawi and Rhodesia. Contract: 2–3 years.

OFFICIAL APPOINTMENTS

TANZANIA

Agricultural Economist

RC 213/267/011

Duties: To lead the Planning and Investigation Unit of the Ministry of Land Settlement and Water Development in the examination and valuation of settlement and irrigation schemes and to train officers engaged on these schemes.

Qualifications and Terms: A degree in economics with agricultural qualifications or an Honours Degree in agricultural economics plus some previous experience. Basic salary scale E.A. Shs. 33,200—36,000 a year (£ Sterling 1,936—2,100) liable to Tanzanian income tax. In addition an inducement allowance, normally tax free, at present in the range of £ Sterling 1,113—1,140 a year will be paid by the British Government direct to an officer's bank account outside East Africa. Terminal gratuity 25% of basic salary and inducement allowance. Contract: 21–27 months.

ST. HELENA

Agricultural and Forestry Officer

RC 213/151/01

Duties: To take charge of the Department which is responsible for forests, grazing and arable land.

Qualifications and Terms: A degree or diploma in agriculture preferably with overseas experience. Salary £1,529—£2,117 a year. 12½% terminal gratuity. Contract: 2 years.

BRUNEI

Soil Scientist

RC 213/28/01

Duties: To set up a Soils Laboratory and to carry out detailed soil surveys in selected areas.

Qualifications and Terms: A degree in Chemistry or Soil Chemistry with 5 years 'post-graduate relevant experience in the tropics.

Salary: Brunei $14,640—26,280 a year. ($1 Brunei = s2/8·7d.). Contract: 3 years.

UGANDA

3 Agricultural Officers (Economist)

RC 213/183/09

Duties: To organise and supervise investigations into the economics of agricultural production of small farms. To advise extension officers on the economic aspects of farm planning.

Qualifications and Terms: A degree in Agriculture or Economics with at least a post-graduate diploma in Economics or Agricultural Economics. Post-graduate experience in Agricultural Economics is desirable.

Basic salary E. A. Shillings 15,960—35,820 a year subject to Uganda Income Tax (£ Sterling 931—2,089). An inducement allowance, normally tax free, in the range of £ Sterling 700—958 a year will be paid by the British Government direct to an officer's bank account in Uganda. Terminal gratuity 25%. Contract 21—27 months.

If you wish to apply for any of these appointments, or you are interested generally in an appointment overseas, please write giving your full name, age and brief particulars of your professional qualifications and experience to the:

Appointments Officer
MINISTRY OF OVERSEAS DEVELOPMENT
Room 324a, Eland House, Stag Place,
London, S.W.1.

MINISTRY OF OVERSEAS DEVELOPMENT